Medicine Lodge Creek Subbasin Total Maximum Daily Loads

2016 Addendum and Five-Year Review

Hydrologic Unit Code 17040215

Public Comment Draft

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Acknowledgments

Cover Photo: Medicine Lodge Creek at the 2002 BURP site (2002SIDFA006), Idaho Department of Environmental Quality, Idaho Falls Regional Office.

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Abbreviations, Acronyms, and Symbols

§	section (usually a section of federal or state rules or statutes)
AU	assessment unit
BLM	United States Bureau of Land Management
BMP	best management practice
BURP	Beneficial Use Reconnaissance Program
C	Celsius
cf	cubic feet
CFR	Code of Federal Regulations (refers to citations in the federal administrative rules)
cfs	cubic feet per second
cfu	colony forming unit
CGP	Construction General Permit
CW	cold water
DEQ	Idaho Department of Environmental Quality
DWS	domestic water supply
E. coli	*Escherichia coli*
EPA	United States Environmental Protection Agency
HUC	hydrologic unit code
IASCD	Idaho Association of Soil Conservation Districts
IDAPA	Refers to citations of Idaho administrative rules
INL	Idaho National Laboratory
kWh	kilowatt hours
LA	load allocation
LC	load capacity
m	meter
m^2	square meter
mL	milliliter
MOS	margin of safety
MS4	municipal separate storm sewer system
MSGP	Multi-Sector General Permit
NB	natural background
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NREL	National Renewable Energy Laboratory
PNV	potential natural vegetation
SCD	soil conservation district
SCR	secondary contact recreation
SEI	streambank erosion inventory
SFI	DEQ’s Stream Fish Index
SHI	DEQ’s Stream Habitat Index
SMI	DEQ’s Stream Macroinvertebrate Index
SS	salmonid spawning
SWPPP	Stormwater Pollution Prevention Plan
TMDL	total maximum daily load
US	United States
USC	United States Code
USGS	United States Geological Survey
WLA	waste load allocation

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Executive Summary

The federal Clean Water Act requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. States and tribes, pursuant to Section 303 of the Clean Water Act, are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation's waters whenever possible. Section 303(d) of the Clean Water Act establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards).

States and tribes must periodically publish a priority list (a "§303(d) list") of impaired waters. Currently, this list is published every 2 years as the list of Category 5 water bodies in Idaho's Integrated Report. For waters identified on this list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants, set at a level to achieve water quality standards. This document addresses 10 water bodies (14 assessment units [AUs]) in the Medicine Lodge Creek subbasin (hydrologic unit code 17040215) that have been placed in Category 5 of Idaho's most recent federally approved Integrated Report (DEQ 2014).

This addendum describes the key physical and biological characteristics of the subbasin; water quality concerns and status; pollutant sources; and recent pollution control actions in the Medicine Lodge Creek subbasin, located in eastern Idaho. More detailed information about the subbasin and previous TMDLs is provided in the *Medicine Lodge Subbasin Assessment and TMDLs* (DEQ 2003).

The TMDL analysis establishes water quality targets and load capacities, estimates existing pollutant loads, and allocates responsibility for load reductions needed to return listed waters to a condition meeting water quality standards. It also identifies implementation strategies—including reasonable time frames, approach, responsible parties, and monitoring strategies—necessary to achieve load reductions and meet water quality standards.

Subbasin at a Glance

The Medicine Lodge Creek subbasin is located in eastern Idaho south of the Beaverhead Mountains of the Continental Divide. It is a closed basin with no surface water exiting its boundaries.

The US Environmental Protection Agency approved the *Medicine Lodge Subbasin Assessment and TMDLs* (hydrologic unit code [HUC] 17040215) in May 2003 (DEQ 2003). Ten AUs were impaired by sediment, including Medicine Lodge, Edie, Irving, Warm Springs, and Crooked Creeks. Temperature impairment was identified in Medicine Lodge, Indian, Middle, Irving, Warm, Horse, Fritz, Webber, Edie, Deep, and Crooked Creeks, incorporating 22 AUs.

Due to additional assessments since the original TMDL and heritage issues with the Idaho Department of Environmental Quality (DEQ) assessment database, the 2012 Integrated Report currently lists 14 AUs in Category 5 for bacteria, sediment, and combined biota/habitat bioassessments (DEQ 2014a). Figure A shows the locations of the listed AUs. Waters currently listed in Category 5 of the 2012 Integrated Report are listed in Table A.

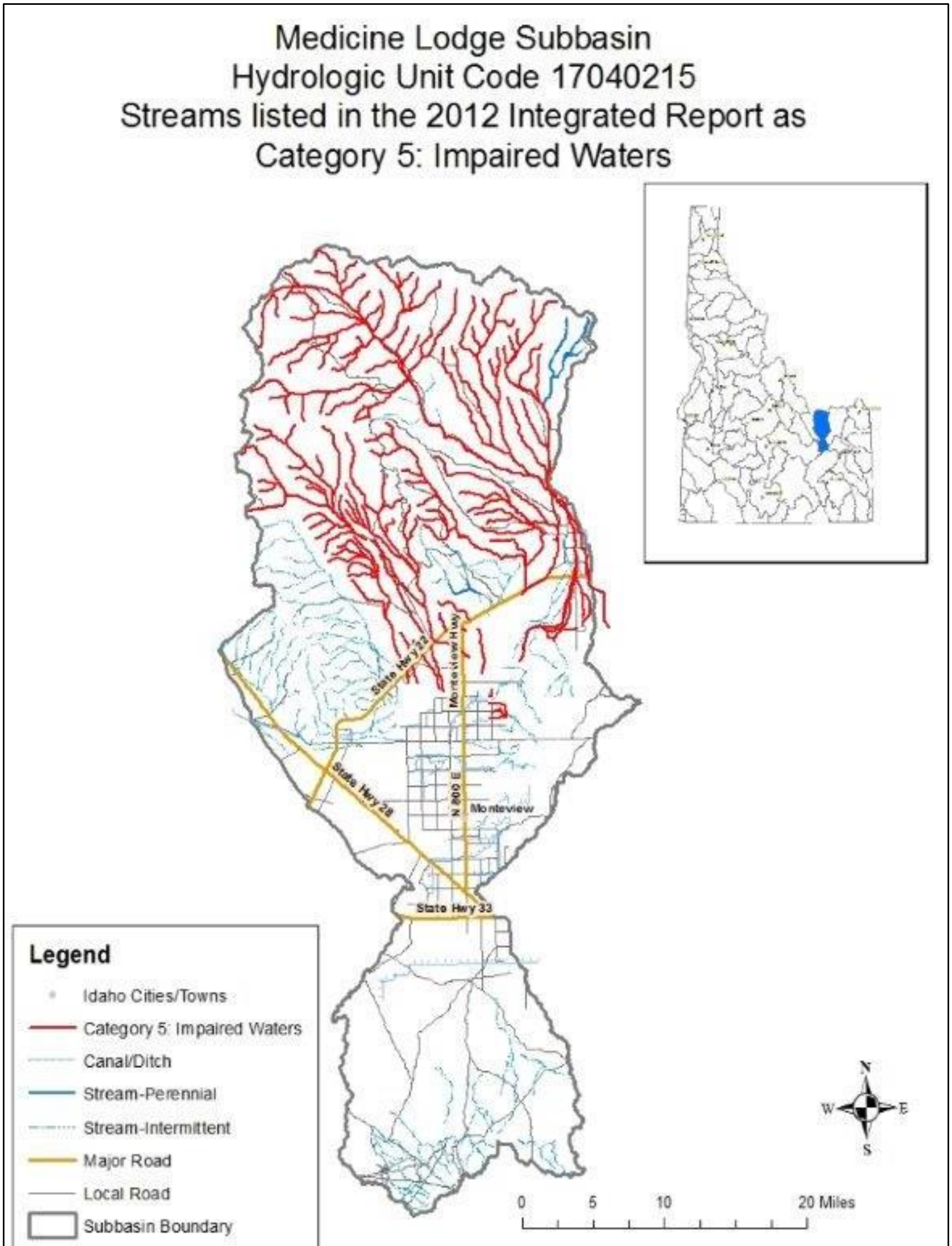

Figure A. Waters currently listed in Category 5 of the 2012 Integrated Report for Medicine Lodge Creek subbasin (HUC 17040215).

Table A. Waters currently listed in Category 5 of the 2012 Integrated Report for Medicine Lodge Creek subbasin (HUC 17040215).

Assessment Unit Name	Assessment Unit Number	Pollutants	Length (miles)
West Fork Indian Creek—source to mouth	ID17040215SK005_02	Combined biota/habitat bioassessments; *Escherichia coli*	24.45
Middle Creek—Dry Creek to mouth	ID17040215SK007_02	Sedimentation/siltation	27.36
Middle Creek—Dry Creek to mouth	ID17040215SK007_03	Fecal coliform	5.61
Middle Creek—source to Dry Creek	ID17040215SK008_02	Sedimentation/siltation	12.12
Dry Creek—source to mouth	ID17040215SK009_02	Sedimentation/siltation	5.2
Edie Creek—source to mouth	ID17040215SK010_02	*Escherichia coli*	10.17
Irving Creek—source to mouth	ID17040215SK012_02	*Escherichia coli*	13.69
Warm Creek—source to mouth	ID17040215SK013_02	Sedimentation/siltation	14.87
Warm Creek—source to mouth (i.e., Divide Creek below the confluence of Warm and Divide Creeks)	ID17040215SK013_03	Sedimentation/siltation	2.44
Divide Creek—source to mouth (i.e., source to Warm Creek)	ID17040215SK014_02	Combined biota/habitat bioassessments; *Escherichia coli*	13.86
Horse Creek—source to mouth	ID17040215SK015_02	Combined biota/habitat bioassessments; sedimentation/siltation	8.42
Deep Creek—source to mouth	ID17040215SK018_02	Combined biota/habitat bioassessments; sedimentation/siltation	77.1
Deep Creek—source to mouth	ID17040215SK018_03	Sedimentation/siltation	8.98
Crooked Creek—source to mouth	ID17040215SK021_02	Combined biota/habitat bioassessments; sedimentation/siltation; *Escherichia coli*	53.08

Key Findings

Perennial water is present in the northern part of Medicine Lodge Creek subbasin, where grazing on rangeland is the primary land use. Historic sediment and bacteria impacts are on an improving trend as cattle are grazed primarily outside riparian corridors. As perennial streams exit the bluffs and flow onto flatter land, surface water disappears into the valley floor of loosely consolidated volcanic soils. Cropland occupies this flat region. Historically, canals had extended the surface water but have been eliminated via conversion from flood irrigation to sprinkler irrigation. Pivot lines share ground water sources as watershed improvement projects have aided in eliminating canals and flood irrigation.

Six AUs are listed for bacteria impairment from historic data. Standards state that waters are not to contain *Escherichia coli* bacteria exceeding a geometric mean of 126 organisms per 100 milliliters (“Water Quality Standards,” IDAPA 58.01.02.251.01.a). Divide, Middle, and West Fork Indian Creeks require bacteria load reductions. Although Edie, Irving, and Crooked

Creeks previously exceeded the bacteria water quality standard, recent monitoring shows that the creeks now meet the bacteria load capacity and will not require bacteria TMDLs. An additional bacteria TMDL will be provided for Medicine Lodge Creek, which was previously unlisted.

A subbasin-wide temperature study documented temperature impairments in the original TMDL (DEQ 2003). These TMDLs were written requiring mass balance temperature reductions. To prioritize reaches for watershed improvement projects where temperature is an impairment, DEQ investigated the subbasin in 2012–2014 for shade. The previous mass balance temperature load reductions have been replaced by measures of total solar load based on average lack of shade. The target condition goal is to achieve system potential shade under potential natural vegetation.

Table B lists the water bodies receiving bacteria and temperature TMDLs in this document.

Table B. Water bodies and pollutants for which new TMDLs were developed or revised.

Water Body	Assessment Unit Number	Pollutant(s)
Medicine Lodge Creek	ID17040215SK002_04	Temperature
Indian Creek	ID17040215SK003_02	Temperature
	ID17040215SK003_03	Temperature
West Fork Indian Creek	ID17040215SK005_02	*Escherichia coli* (*E. coli*)
Middle Creek	ID17040215SK007_02	Temperature
	ID17040215SK007_03	*E. coli;* temperature
	ID17040215SK008_02	Temperature
Edie Creek	ID17040215SK010_02	Temperature
Medicine Lodge Creek	ID17040215SK011_02	Temperature
	ID17040215SK011_03	Temperature
	ID17040215SK011_04	Temperature
Irving Creek	ID17040215SK012_02	Temperature
	ID17040215SK012_03	Temperature
Warm Creek	ID17040215SK013_02	Temperature
	ID17040215SK013_03	Temperature
Divide Creek	ID17040215SK014_02	*E. coli*
Horse Creek	ID17040215SK015_02	Temperature
Fritz Creek	ID17040215SK016_02	Temperature
Webber Creek	ID17040215SK017_02	Temperature
Deep Creek	ID17040215SK018_02	Temperature
	ID17040215SK018_03	Temperature
Crooked Creek	ID17040215SK021_02	Temperature
	ID17040215SK021_03	Temperature

Table C summarizes the TMDLs provided in this document and lists changes to the next Integrated Report.

Table C. Summary of assessment outcomes for §303(d)-listed assessment units and revised TMDLs in Category 4a.

Assessment Unit Name	Assessment Unit Number	Pollutant	TMDL Completed	Recommended Changes to Next Integrated Report	Justification
Medicine Lodge Creek—Indian Creek to playas	ID17040215SK002_04	Temperature	Yes	Keep in Category 4a for temperature	Temperature TMDL revised based on PNV
Indian Creek—confluence of West and East Forks Indian Creek to mouth	ID17040215SK003_02	Temperature	Yes	Keep in Category 4a for temperature	Temperature TMDL revised based on PNV
Indian Creek—confluence of West and East Forks Indian Creek to mouth	ID17040215SK003_03	Temperature	Yes	Keep in Category 4a for temperature	Temperature TMDL revised based on PNV
West Fork Indian Creek—source to mouth	ID17040215SK005_02	Combined biota/habitat bioassessments; *E. coli*	Yes for *E. coli*	List in Category 4a for *E. coli*; keep in Category 5 for combined biota/habitat bioassessment	*E. coli* TMDL completed
Medicine Lodge Creek—Edie Creek to Indian Creek	ID17040215SK006_04	*E. coli; t*emperature	Yes	List in Category 4a for *E. coli;* keep in Category 4a for temperature	*E. coli* TMDL completed—unlisted but impaired; temperature TMDL revised based on PNV
Middle Creek—Dry Creek to mouth	ID17040215SK007_02	Sedimentation/siltation; temperature	Yes for temperature	List in Category 4a for temperature; delist sedimentation/siltation	Temperature TMDL completed based on PNV; sediment listed in error
Middle Creek—Dry Creek to mouth	ID17040215SK007_03	Fecal coliform; temperature	Yes for temperature and *E. coli*	List in Category 4a for *E. coli* and temperature; delist for fecal coliform	Temperature TMDL revised based on PNV; *E. coli* TMDL completed
Middle Creek—source to Dry Creek	ID17040215SK008_02	Sedimentation/siltation; temperature	Yes for temperature	Keep in Category 4a for temperature; keep in Category 5 for sedimentation/siltation	Temperature TMDL completed based on PNV
Dry Creek—source to mouth	ID17040215SK009_02	Sedimentation/siltation	No	List in Category 2	Sediment data do not support listing
Edie Creek—source to mouth	ID17040215SK010_02	*E. coli;* temperature; sediment	Yes for temperature	List in Category 4a for temperature and sediment; delist for *E. coli*	Temperature TMDL completed based on PNV; delist *E. coli* due to attainment
Medicine Lodge Creek—confluence of Warm and Fritz Creeks to Edie Creek	ID17040215SK011_02	Temperature	Yes	Keep in Category 4a for temperature	Temperature TMDL revised based on PNV
Medicine Lodge Creek—confluence of Warm and Fritz Creeks to Edie Creek	ID17040215SK011_03	Temperature	Yes	Keep in Category 4a for temperature	Temperature TMDL revised based on PNV
Medicine Lodge Creek—confluence of Warm and Fritz Creeks to Edie Creek	ID17040215SK011_04	Temperature	Yes	Keep in Category 4a for temperature	Temperature TMDL revised based on PNV

Assessment Unit Name	Assessment Unit Number	Pollutant	TMDL Completed	Recommended Changes to Next Integrated Report	Justification
Irving Creek—source to mouth	ID17040215SK012_02	*E. coli;* temperature	Yes for temperature	List in Category 4a for temperature; delist for *E. coli*	Temperature TMDL completed based on PNV; delist *E. coli* due to attainment
Irving Creek—source to mouth	ID17040215SK012_03	Temperature	Yes	Keep in Category 4a for temperature	Temperature TMDL revised based on PNV
Warm Creek—source to mouth	ID17040215SK013_02	Sedimentation/siltation; temperature	Yes for temperature	List in Category 4a for temperature; keep in Category 5 for sedimentation/siltation	Temperature TMDL completed based on PNV
Warm Creek—source to mouth (i.e., Divide Creek below the confluence of Warm and Divide)[a]	ID17040215SK013_03	Sedimentation/siltation; temperature; *E. coli*	Yes for temperature and *E. coli*	List in Category 4a for temperature and *E. coli*; keep in Category 5 for sedimentation/siltation	Temperature TMDL completed based on PNV; *E.coli* TMDL completed; bacteria sampling that resulted in *E. coli* listing in 014_02 occurred in this AU
Divide Creek—source to mouth (i.e., source to Warm Creek)	ID17040215SK014_02[a]	Combined biota/habitat bioassessments; *E. coli*	No	List in Category 2; delist for combined biota/habitat bioassessments and *E. coli*	Delist combined biota/habitat bioassessment and *E. coli* due to assessment errors
Horse Creek—source to mouth	ID17040215SK015_02	Combined biota/habitat bioassessments; sedimentation/siltation; temperature	Yes for temperature	List in Category 4a for temperature; keep in Category 5 for combined biota/habitat bioassessments and sedimentation/siltation	Temperature TMDL completed based on PNV
Fritz Creek—source to mouth	ID17040215SK016_02	Temperature	Yes	Keep in Category 4a for temperature	Temperature TMDL revised based on PNV
Webber Creek	ID17040215SK017_02	Temperature	Yes	Keep in Category 4a for temperature	Temperature TMDL revised based on PNV
Deep Creek—source to mouth	ID17040215SK018_02	Combined biota/habitat bioassessments; sedimentation/siltation; temperature	Yes for temperature	List in Category 4a for temperature; keep in Category 5 for combined biota/habitat bioassessments and sedimentation/siltation	Temperature TMDL completed based on PNV
Deep Creek—source to mouth	ID17040215SK018_03	Sedimentation/siltation; temperature	Yes for temperature	List in Category 4a for temperature; delist for sedimentation/siltation	Temperature TMDL completed based on PNV; delist sediment—temperature is sole impairment
Crooked Creek—source to mouth	ID17040215SK021_02	Combined biota/habitat bioassessments; sedimentation/siltation; *E. coli;* temperature	Yes for temperature	List in Category 4a for temperature; keep in Category 5 for combined biota/habitat bioassessments and sedimentation/siltation; delist for *E. coli*	Temperature TMDL completed based on PNV; delist *E. coli* for attainment
Crooked Creek—source to mouth	ID17040215SK021_03	Temperature	Yes	Keep in Category 4a for temperature	Temperature TMDL revised based on PNV

a. According to the 2010 Integrated Report, bacteria sampling for Divide Creek (ID17040215SK014_02) was collected downstream in what the Integrated Report calls Warm Creek AU (ID17040215SK013_03) where there was water.

Notes: Total maximum daily load (TMDL), *Escherichia coli (E. coli*), potential natural vegetation (PNV), assessment unit (AU).

Public Participation

Development of this Medicine Lodge Creek subbasin TMDL addendum and 5-year review will include a public comment period on the draft document. The Clark Soil Conservation District (SCD) agreed to act as a Watershed Advisory Group for the Medicine Lodge Creek subbasin. In accordance with Idaho Code §39-3601 et. seq., Clark SCD, representing the agricultural interests, invited other interested sectors (e.g., environmental or timber) to vote on TMDL development in the subbasin Clark SCD reviewed the public comment draft TMDL addendum, and upon approval, the TMDL addendum will be advertised for public comment.

After all interested parties have an opportunity to review and comment on the water quality issues impacting this subbasin, DEQ will respond to the comments by amending the document or clarifying issues as necessary. Comments received from the public and DEQ's response to those comments, as well as a distribution list, will be published in the final TMDL addendum.

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Introduction

This document addresses 10 water bodies (14 assessment units [AUs]) in the Medicine Lodge Creek subbasin that have been placed in Category 5 of Idaho's most recent federally approved Integrated Report (DEQ 2014a) and 22 AUs with existing temperature TMDLs that have been revised using the potential natural vegetation (PNV) methodology as a shade surrogate for temperature. This total maximum daily load (TMDL) addendum and 5-year review characterizes and documents pollutant loads within the Medicine Lodge Creek subbasin. The first portion of this document presents key characteristics or updated information for the subbasin assessment, which is divided into four major sections: subbasin characterization (section 1), water quality concerns and status (section 2), pollutant source inventory (section 3), and a summary of past and present pollution control efforts (section 4). While the subbasin assessment is not a requirement of the TMDL, the Idaho Department of Environmental Quality (DEQ) performs the assessment to ensure impairment listings are up-to-date and accurate.

The subbasin assessment is used to develop a TMDL for each pollutant of concern for the Medicine Lodge Creek subbasin. The TMDL (section 5) is a plan to improve water quality by limiting pollutant loads. Specifically, a TMDL estimates the maximum pollutant amount that can be present in a water body and still allow that water body to meet water quality standards (40 CFR 130). Consequently, a TMDL is water body- and pollutant-specific. The TMDL also allocates allowable discharges of individual pollutants among the various sources discharging the pollutant.

Regulatory Requirements

This document was prepared in compliance with both federal and state regulatory requirements. The federal government, through the US Environmental Protection Agency (EPA), assumed the dominant role in defining and directing water pollution control programs across the country. DEQ implements the Clean Water Act in Idaho, while EPA oversees Idaho and certifies the fulfillment of Clean Water Act requirements and responsibilities.

Congress passed the Federal Water Pollution Control Act, more commonly called the Clean Water Act, in 1972. The goal of this act was to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (33 USC §1251). The act and programs it has generated have changed over the years as experience and perceptions of water quality have changed. The Clean Water Act has been amended 15 times, most significantly in 1977, 1981, and 1987. One of the goals of the 1977 amendment was protecting and managing waters to ensure "swimmable and fishable" conditions. These goals relate water quality to more than just chemistry.

The Clean Water Act requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. States and tribes, pursuant to Section 303 of the Clean Water Act, are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation's waters whenever possible. DEQ must review those standards every 3 years, and EPA must approve Idaho's water quality standards. Idaho adopts water quality standards to protect public health and welfare, enhance water quality, and protect biological integrity. A water quality standard defines the goals of a water body by designating the use or uses for the water, setting criteria necessary to protect those uses, and preventing degradation of water quality through antidegradation provisions.

Section 303(d) of the Clean Water Act establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards). States and tribes must periodically publish a priority list (a "§303(d) list") of impaired waters. Currently, this list is published every 2 years as the list of Category 5 waters in Idaho's Integrated Report. For waters identified on this list, states and tribes must develop a TMDL for the pollutants, set at a level to achieve water quality standards.

DEQ monitors waters, and for those not meeting water quality standards, DEQ must establish a TMDL for each pollutant impairing the waters. However, some conditions that impair water quality do not require TMDLs. EPA considers certain unnatural conditions—such as flow alteration, human-caused lack of flow, or habitat alteration—that are not the result of discharging a specific pollutant as "pollution." TMDLs are not required for water bodies impaired by pollution, rather than a specific pollutant. A TMDL is only required when a pollutant can be identified and in some way quantified.

1 Subbasin Assessment—Subbasin Characterization

Features of the Medicine Lodge Creek subbasin, tributary watersheds, and descriptions of individual streams are discussed extensively in the original TMDL (DEQ 2003). Comprehensive biological and instream water quality data were presented and analyzed in that document. This TMDL addendum and 5-year review summarizes pertinent characteristics and provides additional data that affect water quality and beneficial uses in the Medicine Lodge Creek subbasin.

Medicine Lodge Creek subbasin (Figure 1) is a closed basin, with no surface water connections outside the subbasin boundaries. Indian, Middle, Webber, Irving, Warm, and Horse Creeks flow into Medicine Lodge Creek, which sinks into the earth about 4.5 miles south of state Highway 22. Other streams in the watershed, Deep, Warm Springs, and Crooked Creeks, sink into the loosely consolidated volcanic soils and do not connect with Medicine Lodge Creek.

Where perennial water is present in the Medicine Lodge Creek subbasin, grazing on rangeland is the primary land use. Cropland is predominant lower in the subbasin, where surface water had historically been extended by canals. However, conversion to sprinkler irrigation supplied by ground water has eliminated flood irrigation as watershed improvement projects have been completed throughout the cropland. The subbasin is almost divided into thirds, with the northern third containing rangeland and perennial water. The middle third contains gullies where the streams come out of the hills and sink into the valley floor alluvium. This area is flat and bounded by Highway 22 on the north and Highway 33 on the south and contains cropland with sprinkler irrigation. The southern third, south of Highway 33, contains no surface water, with the Idaho National Laboratory (INL) covering much of this land area. Figure 1 shows the location, general terrain, and perennial streams of the Medicine Lodge Creek subbasin.

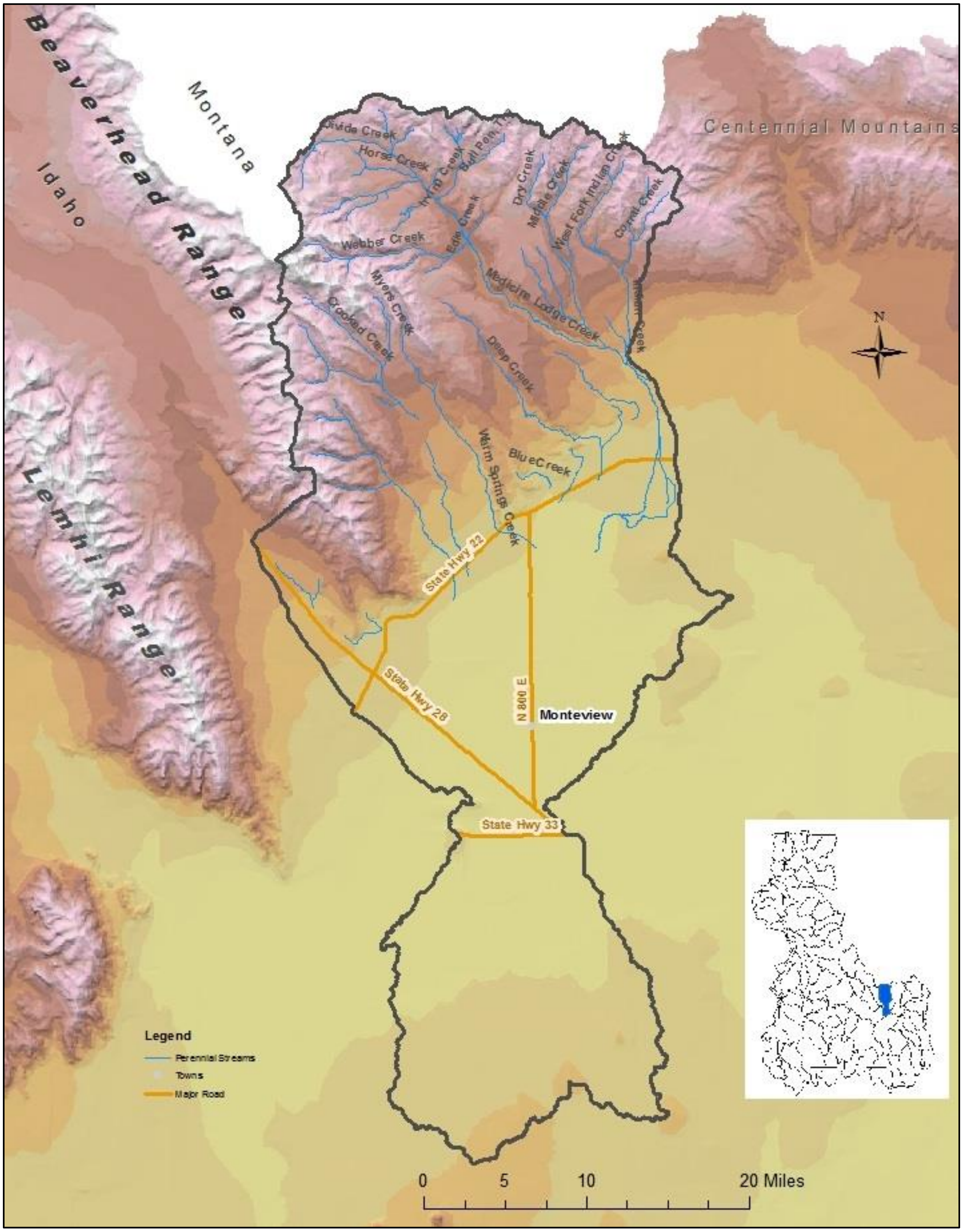
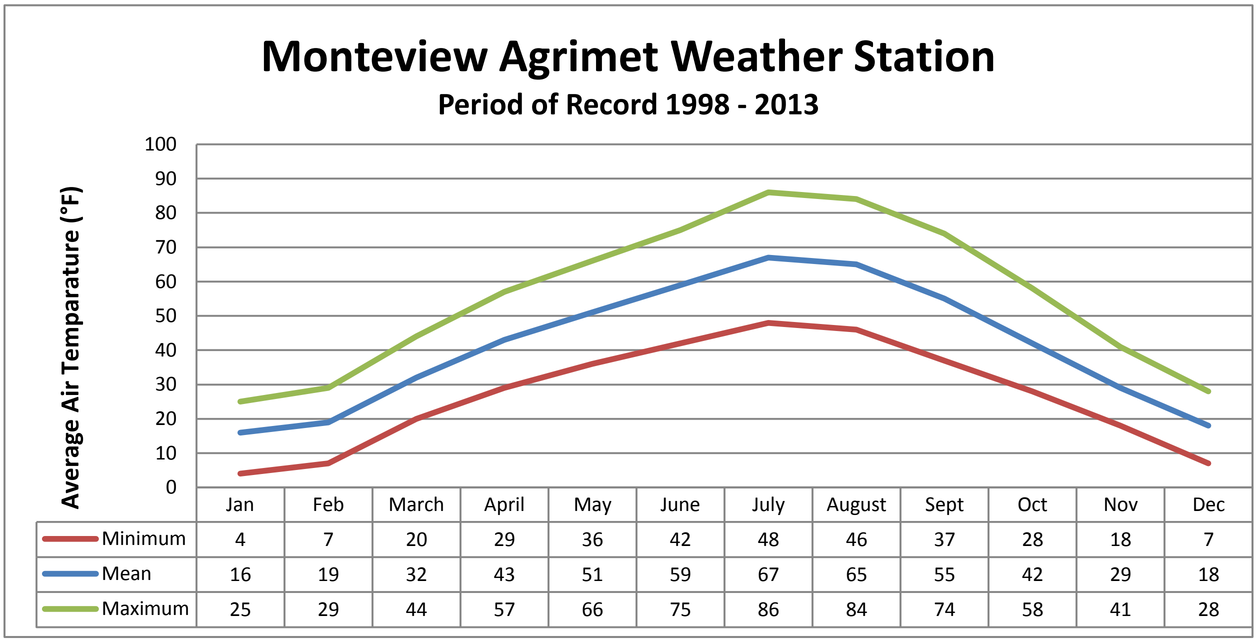


Figure 1. Medicine Lodge Creek subbasin in east-central Idaho.

1.1 Climate and Hydrology

The Pacific Northwest Cooperative Agricultural Weather Network maintains an AgriMet station in the Medicine Lodge Creek subbasin at Monteview, Idaho—the only town in the subbasin. In the period of record for this weather station from 1998 through 2013, annual precipitation averages 6.3 inches. Average monthly temperatures are shown in Figure 2.



	Jan	Feb	March	April	May	June	July	August	Sept	Oct	Nov	Dec
Minimum	4	7	20	29	36	42	48	46	37	28	18	7
Mean	16	19	32	43	51	59	67	65	55	42	29	18
Maximum	25	29	44	57	66	75	86	84	74	58	41	28

Figure 2. Average air temperatures at Monteview, Idaho.

Minimum temperatures average 27°F; mean temperatures average 41°F; and maximum temperatures average 56°F.

Hydrologic data are limited in the subbasin to streamflow records for Medicine Lodge Creek. The mean discharge for daily mean values for the period of record is shown in Figure 3.

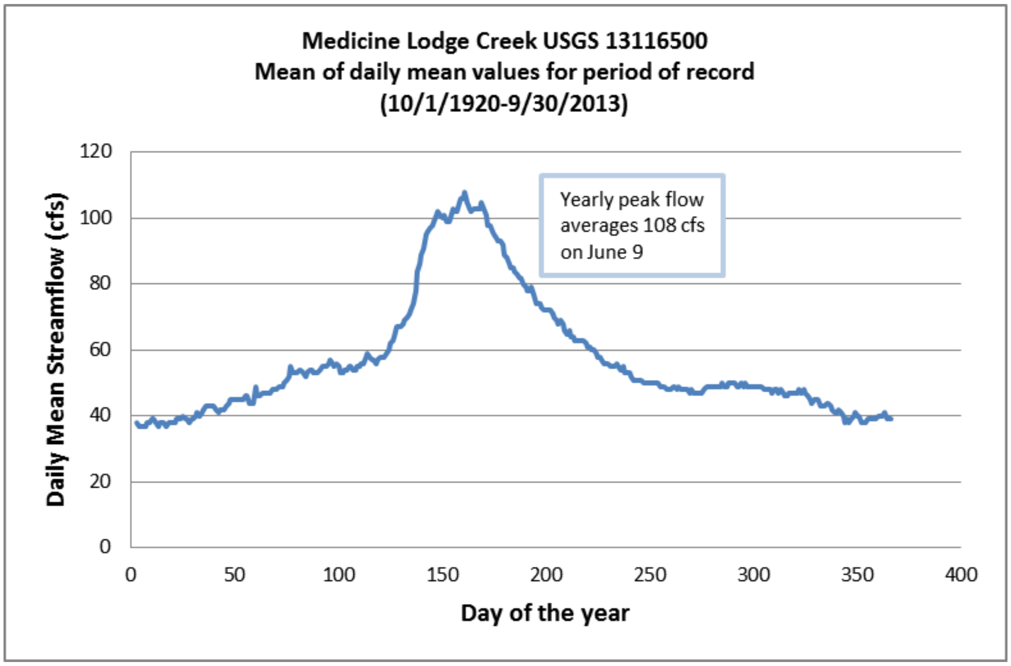


Figure 3. Medicine Lodge Creek USGS 13116500 daily mean streamflow.

The percentile flow values for the entire period of record are shown in Figure 4.

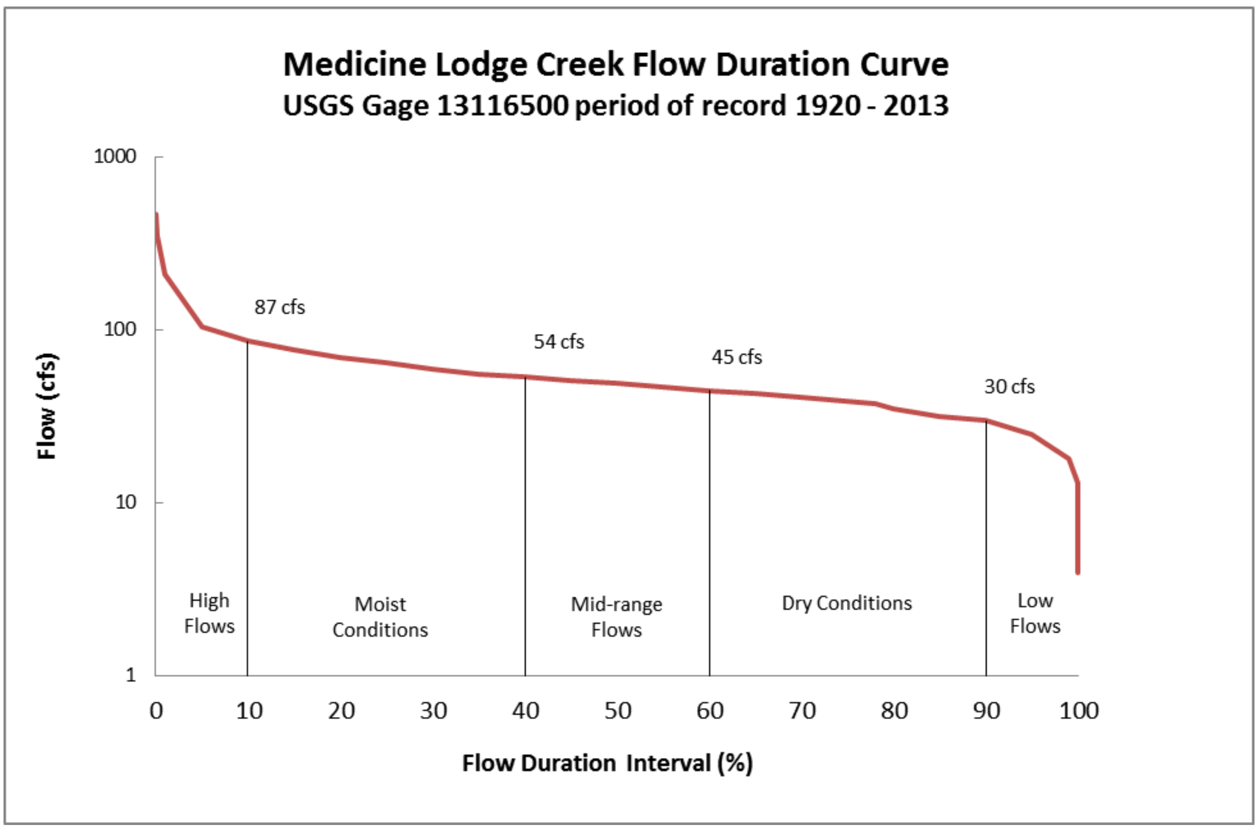


Figure 4. Flow duration curve for Medicine Lodge Creek USGS gage 13116500.

Using flow duration intervals to describe these five hydrological periods is based on the work of Bruce Cleland (EPA 2007). Analyzing the flow data for this subbasin, the hydrologic periods based on flow data in the entire period of record equal the following:

- Low flows: 4–29 cubic feet per second (cfs). Do not occur in the average year.
- Dry conditions: 30–44 cfs. Occur in the winter from late November through mid-February.
- Midrange flows: 45–53 cfs. Occur in the spring from mid-February through March and in the fall from August 25 through November 26.
- Moist conditions: 54–86 cfs. Occur from April 1 through May 17 and from July 1 through August 24.
- High flows: 87–470 cfs. Occur from May 18 through June 30.

The hydrological analysis used to produce this information is provided in Appendix A.

1.2 Land Ownership and Population

Since the original TMDL (DEQ 2003), the delineation of many watersheds has been updated and revised through a cooperative effort among the Idaho Department of Water Resources, Natural Resources Conservation Service (NRCS), and various state and local agencies. *The Idaho Watershed Boundary 5th and 6th Field Delineation Project* (IDWR 2008) implemented changes in many Idaho watershed boundaries to coordinate them with surrounding states and to more accurately reflect drainage patterns. Consequently, for the Medicine Lodge Creek subbasin, the total acreage, proportions in landownership distribution and other land area issues may differ from the original TMDL analysis. Table 1 and Figure 5 detail the current distribution of landownership for this subbasin. In the Medicine Lodge Creek subbasin, the redelineation altered the total land area and proportions in landownership distribution, including an addition of over 160,000 acres from the watershed delineation reported in the 2003 TMDL. Most of the additional acreage is managed by the US Department of Energy for the INL. The most significant alteration is that Mud Lake is now outside the boundaries of this subbasin and located in the Beaver-Camas subbasin to the east.

Table 1. Current landownership in the Medicine Lodge Creek subbasin.

Landowner	Acres	Square Miles	Distribution
US Bureau of Land Management	238,382	373	
US Department of Energy	167,894	262	77% public land
Forest	156,083	244	
State	10,259	16	
Private	169,722	265	23% private land
Total	742,340	1,160	—

The US Bureau of Land Management (BLM) administers the largest portion of public lands through the Upper Snake Field Office, Idaho Falls District. The Dubois Ranger District of the Caribou-Targhee National Forest manages the upland regions of shrubland and forested slopes.

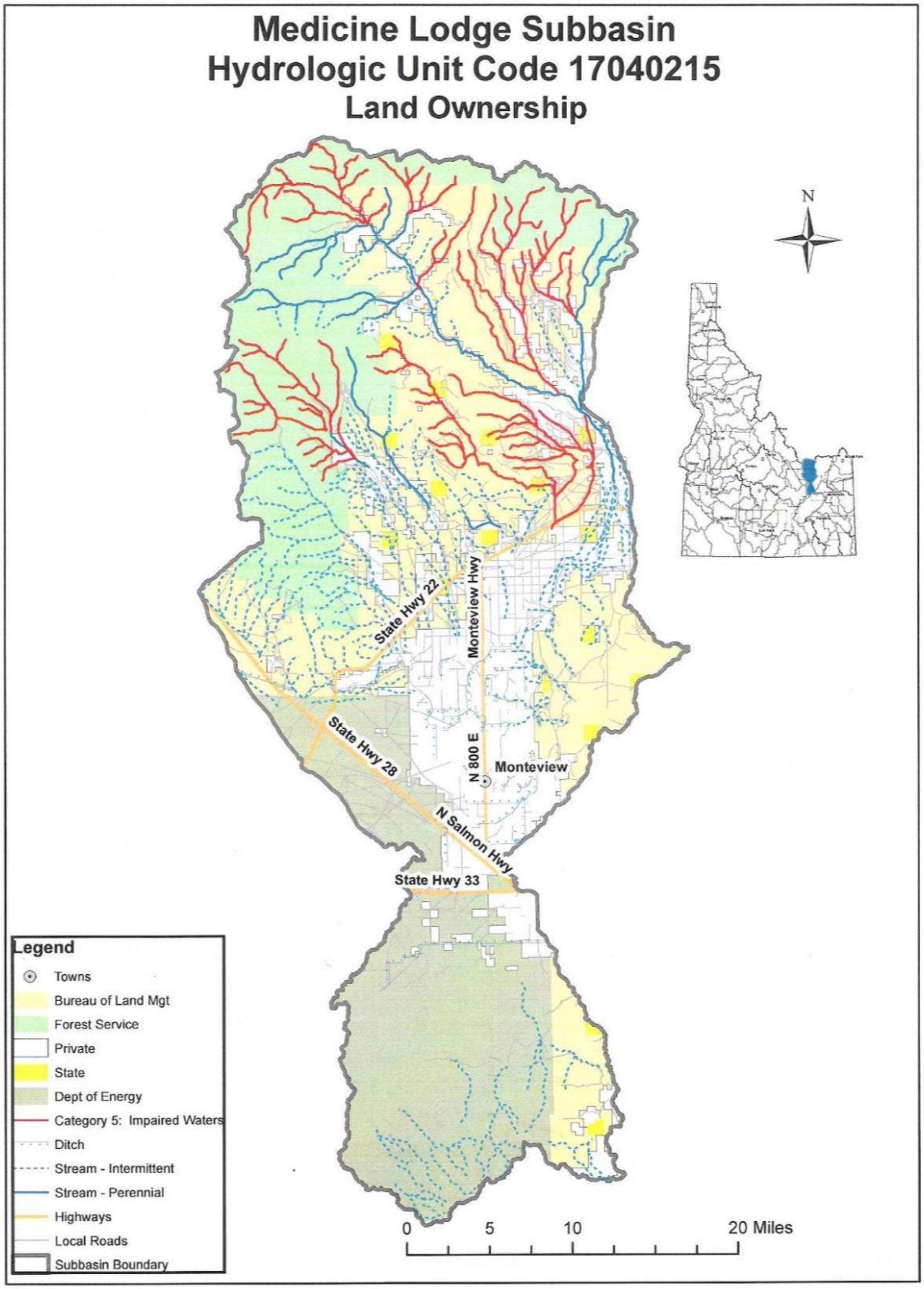


Figure 5. Landowner distribution.

The land area in this subbasin is all rural, lying mainly within Clark County. Monteview, an unincorporated community shown in Figure 6 is the only town within Medicine Lodge Creek subbasin. According to the National Agricultural Statistics Service (2012), within the Monteview zip code, there is a population of 512 people with 32 farm operations.

Figure 6. Monteview, Idaho—only town in Medicine Lodge Creek subbasin.

The Clark Soil Conservation District (SCD) 5-year resource conservation business plan (Clark SCD 2013) provides a detailed analysis of the economic conditions and assessment of soil resources for this area.

2 Subbasin Assessment—Water Quality Concerns and Status

2.1 Water Quality Limited Assessment Units Occurring in the Subbasin

Section 303(d) of the Clean Water Act states that waters that are unable to support their beneficial uses and do not meet water quality standards must be listed as water quality limited. Subsequently, these waters are required to have TMDLs developed to bring them into compliance with water quality standards.

2.1.1 Assessment Units

AUs are groups of similar streams that have similar land use practices, ownership, or land management. However, stream order is the main basis for determining AUs—even if ownership and land use change significantly, the AU usually remains the same for the same stream order.

Using AUs to describe water bodies offers many benefits primarily that all waters of the state are defined consistently. AUs are a subset of water body identification numbers, which allows them to relate directly to the water quality standards.

2.1.2 Listed Waters

Table 2 lists the pollutants and listing basis for each §303(d)-listed AU in the subbasin (i.e., AUs in Category 5 of the Integrated Report).

Table 2. Medicine Lodge Creek subbasin §303(d)-listed assessment units.

Assessment Unit Name (as listed in the 2012 Integrated Report)	Assessment Unit Number	Listed Pollutants	Listing Basis
West Fork Indian Creek—source to mouth	ID17040215SK005_02	Combined biota/habitat bioassessments; *Escherichia coli* (*E. coli*)	2002 Integrated Report for unknown and pathogens due to 1998 BURP data.
Middle Creek—Dry Creek to mouth	ID17040215SK007_02	Sedimentation/siltation	2008 Integrated Report for sediment due to field audits with US Bureau of Land Management (BLM)
Middle Creek—Dry Creek to mouth	ID17040215SK007_03	Fecal coliform	2002 Integrated Report for unknown and pathogens from 1997 data.
Middle Creek—source to Dry Creek	ID17040215SK008_02	Sedimentation/siltation	2002Integrated Report for sediment due to field audits with BLM.
Dry Creek—source to mouth	ID17040215SK009_02	Sedimentation/siltation	2002 Integrated Report due to 1998 BURP data and/or for sediment due to field audits with BLM, which are not applicable for listing purposes
Edie Creek—source to mouth	ID17040215SK010_02 (WQLS 2210)	*E. coli*	1994 §303(d) list, referencing Appendix D of 1992 water quality status report. Listed due to BLM monitoring data and DEQ evaluation.
Irving Creek—source to mouth	ID17040215SK012_02 (WQLS 2211)	*E. coli*	1994 §303(d) list, referencing Appendix D of 1992 water quality status report. Listed due to BLM monitoring data and DEQ evaluation.
Warm Creek—source to mouth	ID17040215SK013_02 (WQLS 2215)	Sedimentation/siltation	1994 §303(d) list, referencing Appendix D of 1992 water quality status report. Listed in 2008 Integrated Report due to DEQ evaluation.
Warm Creek—source to mouth	ID17040215SK013_03	Sedimentation/siltation	2008 Integrated Report for sediment due to 1994/1995 bioassessments and field audits with BLM.
Divide Creek—source to mouth	ID17040215SK014_02	Combined biota/habitat bioassessments; *E. coli*	2002 Integrated Report for pathogens (1997 data); combined biota listed in the 2010 Integrated Report based on 1997 bioassessments.

Assessment Unit Name (as listed in the 2012 Integrated Report)	Assessment Unit Number	Listed Pollutants	Listing Basis
Horse Creek—source to mouth	ID17040215SK015_02	Combined biota/habitat bioassessments; sedimentation/siltation	2002 Integrated Report for unknown and sediment due to 1997 and 1998 BURP data.
Deep Creek—source to mouth	ID17040215SK018_02	Combined biota/habitat bioassessments; sedimentation/siltation	2002 Integrated Report for “unknown” based on 1998 BURP data; sediment listed in the 2008 Integrated Report due to field audits with BLM.
Deep Creek—source to mouth	ID17040215SK018_03	Sedimentation/siltation	2008 Integrated Report for sediment due to field audits with BLM.
Crooked Creek—source to mouth	ID17040215SK021_02	Combined biota/habitat bioassessments; sedimentation/siltation; *E. coli*	2002 Integrated Report for unknown based on 1997 BURP data; sediment listed in the 2008 Integrated Report due to BURP data and *E.coli* listed in the 2010 Integrated Report due to the geometric mean of 676 colony forming units per 100 milliliters presumably collected in either 1997 or 2003.

Figure 7 shows the location of the §303(d)-listed AUs in the subbasin.

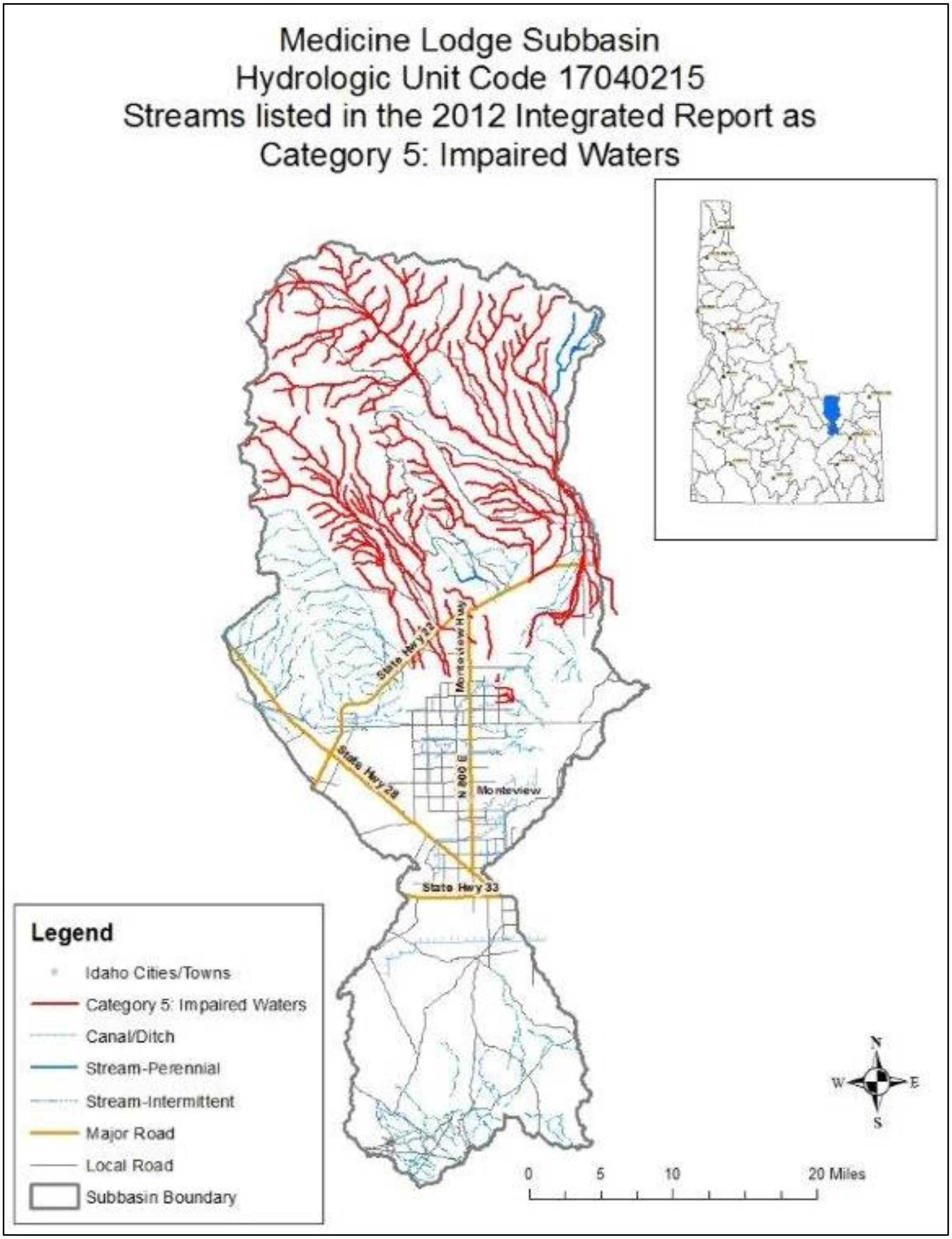


Figure 7. Waters currently listed in Category 5 of the 2012 Integrated Report for Medicine Lodge Creek subbasin (HUC 17040215).

2.2 Applicable Water Quality Standards and Beneficial Uses

Idaho water quality standards (IDAPA 58.01.02) list beneficial uses and set water quality goals for waters of the state. Idaho water quality standards require that surface waters of the state be protected for beneficial uses, wherever attainable (IDAPA 58.01.02.050.02). These beneficial uses are interpreted as existing uses, designated uses, and presumed uses as described briefly in the following paragraphs. The *Water Body Assessment Guidance* (Grafe et al. 2002) provides a more detailed description of beneficial use identification for use assessment purposes.

Beneficial uses include the following:

- Aquatic life support—cold water, seasonal cold water, warm water, salmonid spawning, and modified
- Contact recreation—primary (swimming) or secondary (boating)
- Water supply—domestic, agricultural, and industrial
- Wildlife habitats
- Aesthetics

2.2.1 Existing Uses

Existing uses under the Clean Water Act are "those uses actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards" (40 CFR 131.3). The existing instream water uses and the level of water quality necessary to protect the uses shall be maintained and protected (IDAPA 58.01.02.051.01). Existing uses need to be protected, whether or not the level of water quality to fully support the uses currently exists. A practical application of this concept would be to apply the existing use of salmonid spawning to a water body that supported salmonid spawning since November 28, 1975, but does not now due to other factors, such as blockage of migration, channelization, sedimentation, or excess heat.

2.2.2 Designated Uses

Designated uses under the Clean Water Act are "those uses specified in water quality standards for each water body or segment, whether or not they are being attained" (40 CFR 131.3). Designated uses are simply uses officially recognized by the state. In Idaho, these include uses such as aquatic life support, recreation in and on the water, domestic water supply, and agricultural uses. Multiple uses often apply to the same water; in this case, water quality must be sufficiently maintained to meet the most sensitive use (designated or existing). Designated uses may be added or removed using specific procedures provided for in state law, but the effect must not be to preclude protection of an existing higher quality use such as cold water aquatic life or salmonid spawning. Designated uses are described in the Idaho water quality standards (IDAPA 58.01.02.100) and specifically listed by water body in sections 110–160.

2.2.3 Undesignated Surface Water and Presumed Use Protection

In Idaho, due to a change in scale of cataloging waters in 2000, most water bodies listed in the tables of designated uses in the water quality standards do not yet have specific use designations (IDAPA 58.01.02.110–160). The water quality standards have three sections that address nondesignated waters. Sections 101.02 and 101.03 specifically address nondesignated man-made waterways and private waters. Man-made waterways and private waters have no presumed use protections. Man-made waters are protected for the use for which they were constructed unless otherwise designated in the water quality standards. Private waters are not protected for any beneficial uses unless specifically designated in the water quality standards.

All other undesignated waters are addressed by section 101.01. Under this section, absent information on existing uses, DEQ presumes that most Idaho waters will support cold water aquatic life and either primary or secondary contact recreation (IDAPA 58.01.02.101.01). To protect these so-called presumed uses, DEQ applies the numeric cold water and recreation criteria to undesignated waters. If in addition to presumed uses, an additional existing use (e.g., salmonid spawning) exists, then the additional numeric criteria for salmonid spawning would also apply (e.g., intergravel dissolved oxygen, temperature) because of the requirement to protect water quality for that existing use. However, if some other use that requires less stringent criteria for protection (such as seasonal cold aquatic life) is found to be an existing use, then a use designation (rulemaking) is needed before that use can be applied in lieu of cold water criteria (IDAPA 58.01.02.101.01).

2.2.4 Beneficial Uses in the Subbasin

Table 3 lists the beneficial uses of the §303(d)-listed streams in Medicine Lodge Creek subbasin.

Table 3. Medicine Lodge Creek subbasin beneficial uses of §303(d)-listed streams.

Assessment Unit Name	Assessment Unit Number	Beneficial Uses	Type of Use
Medicine Lodge Creek—Indian Creek to playas	ID17040215SK002_04	CW, SS, PCR, DWS	Designated
Indian Creek—confluence of West and East Forks Indian Creek to mouth	ID17040215SK003_02	CW, SCR	Presumed
Indian Creek—confluence of West and East Forks Indian Creek to mouth	ID17040215SK003_03	CW, SCR	Presumed
West Fork Indian Creek—source to mouth	ID17040215SK005_02	CW, SS, SCR	Designated
Medicine Lodge Creek—Edie Creek to Indian Creek	ID17040215SK006_04	CW, SS, PCR, DWS	Designated
Middle Creek—Dry Creek to mouth	ID17040215SK007_02	CW, SCR	Presumed
Middle Creek—Dry Creek to mouth	ID17040215SK007_03	CW, SCR	Presumed
Middle Creek—source to Dry Creek	ID17040215SK008_02	CW, SCR	Presumed
Dry Creek—source to mouth	ID17040215SK009_02	CW, SCR	Presumed
Edie Creek—source to mouth	ID17040215SK010_02	CW, SS, SCR	Designated
Medicine Lodge Creek—confluence of Warm and Fritz Creeks to Edie Creek	ID17040215SK011_02	CW, SS, PCR, DWS	Designated
Medicine Lodge Creek—confluence of Warm and Fritz Creeks to Edie Creek	ID17040215SK011_03	CW, SS, PCR, DWS	Designated
Medicine Lodge Creek—confluence of Warm and Fritz Creeks to Edie Creek	ID17040215SK011_04	CW, SS, PCR, DWS	Designated
Irving Creek—source to mouth	ID17040215SK012_02	CW, SS, SCR	Designated
Irving Creek—source to mouth	ID17040215SK012_03	CW, SS, SCR	Designated

Assessment Unit Name	Assessment Unit Number	Beneficial Uses	Type of Use
Warm Creek—source to mouth	ID17040215SK013_02	CW, SS, SCR	Designated
Warm Creek—source to mouth	ID17040215SK013_03	CW, SCR	Presumed
Divide Creek—source to mouth	ID17040215SK014_02	CW, SCR	Presumed
Horse Creek—source to mouth	ID17040215SK015_02	CW, SCR	Presumed
Fritz Creek—source to mouth	ID17040215SK016_02	CW, SS, SCR	Designated
Webber Creek—source to mouth	ID17040215SK017_02	CW, SS, SCR	Designated
Deep Creek—source to mouth	ID17040215SK018_02	CW, SCR	Presumed
Deep Creek—source to mouth	ID17040215SK018_03	CW, SCR	Presumed
Warm Springs Creek—source to mouth	ID17040215SK020_02	CW, SCR	Presumed
Warm Springs Creek—source to mouth	ID17040215SK020_03	CW, SCR	Presumed
Crooked Creek—source to mouth	ID17040215SK021_02	CW, SCR	Presumed
Crooked Creek—source to mouth	ID17040215SK021_03	CW, SCR	Presumed

Notes: Cold water (CW), salmonid spawning (SS), primary contact recreation (PCR), secondary contact recreation (SCR), and domestic water supply (DWS)

The AUs remaining AUs are unassessed; there are no AUs in this subbasin that are assessed but unlisted.

2.2.5 Water Quality Criteria to Support Beneficial Uses

Beneficial uses are protected by a set of water quality criteria, which include *numeric* criteria for pollutants such as bacteria, dissolved oxygen, pH, ammonia, temperature, and turbidity, and *narrative* criteria for pollutants such as sediment and nutrients (IDAPA 58.01.02.250–251) (Table 4).

Table 4. Selected numeric criteria supportive of designated beneficial uses in Idaho water quality standards.

Parameter	Primary Contact Recreation	Secondary Contact Recreation	Cold Water Aquatic Life	Salmonid Spawning
Water Quality Standards: IDAPA 58.01.02.250–251				
Bacteria[a]				
Geometric mean	<126 *E. coli*/100 mL	<126 *E. coli*/100 mL	—	—
Single sample	≤406 *E. coli*/100 mL	≤576 *E. coli*/100 mL	—	—
Temperature[b]	—	—	22 °C or less daily maximum; 19 °C or less daily average	13 °C or less daily maximum; 9 °C or less daily average

[a] *Escherichia coli* per 100 milliliters
[b] Temperature exemption: Exceeding the temperature criteria will not be considered a water quality standard violation when the air temperature exceeds the 90th percentile of the 7-day average daily maximum air temperature calculated in yearly series over the historic record measured at the nearest weather reporting station.

Appendix B describes temperature water quality standards and how they relate to salmonid spawning and natural background provisions.

Narrative criteria for excess sediment are described in the water quality standards:

> Sediment shall not exceed quantities specified in Sections 250 and 252, or, in the absence of specific sediment criteria, quantities which impair designated beneficial uses. Determinations of impairment shall be based on water quality monitoring and surveillance and the information utilized as described in Subsection 350. (IDAPA 58.01.02.200.08)

DEQ's procedure to determine whether a water body fully supports designated and existing beneficial uses is outlined in IDAPA 58.01.02.050.02. The procedure relies heavily upon biological parameters and is presented in detail in the *Water Body Assessment Guidance* (Grafe et al. 2002). This guidance requires DEQ to use the most complete data available to make beneficial use support status determinations (Figure 8).

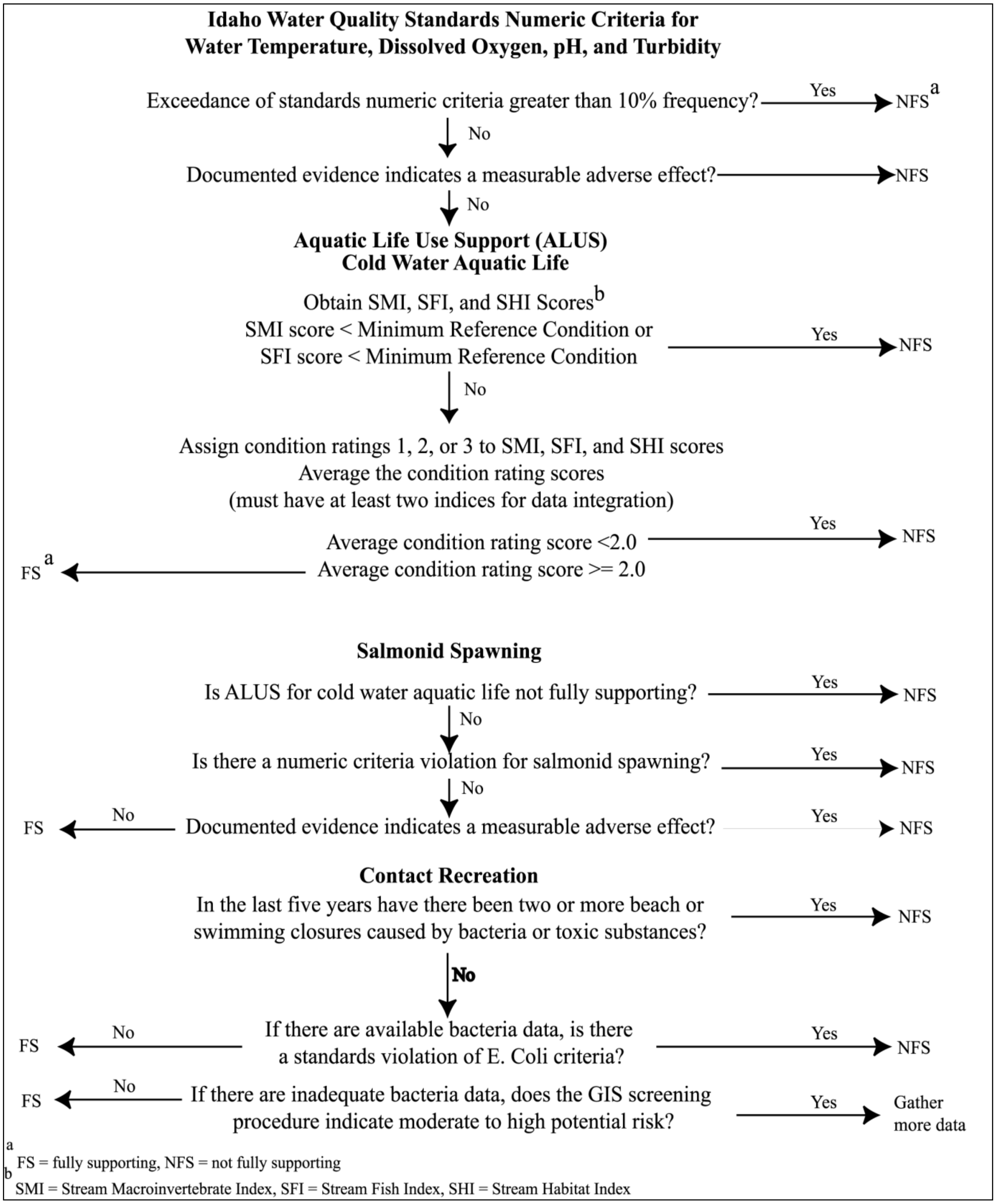


Figure 8. Determination steps and criteria for determining support status of beneficial uses in wadeable streams (Grafe et al. 2002).

2.3 Summary and Analysis of Existing Water Quality Data

This section provides additional data collected since publication of the original TMDL (DEQ 2003).

2.3.1 Water Column Data

2.3.1.1 Water Chemistry

Clark SCD requested the Idaho Association of Soil Conservation Districts (IASCD) to monitor water quality in the Medicine Lodge Creek subbasin to plan implementation of voluntary agricultural best management practices (BMPs) throughout the subbasin (IASCD 2005). IASCD monitored three sites on Medicine Lodge Creek, one site on Edie Creek, and one site on Irving Creek for total suspended solids and nutrients and found that they met commonly accepted targets with the exception of nitrogen concentrations. Nitrogen concentrations fluctuated throughout the year and were higher in the upper reaches than at the lower Medicine Lodge Creek sites. There was no seasonal or spatial trend to the nitrogen fluctuations, which occurred in relatively undisturbed sites with limited rangeland uses. If grazing was the source of nitrogen, then elevated levels of sediment and phosphorus would be found along with the nitrogen fluctuations. This study concluded that nitrogen sources could be from ground water in these upper reaches. Graphs showing the results of this study are included in Figure 9.

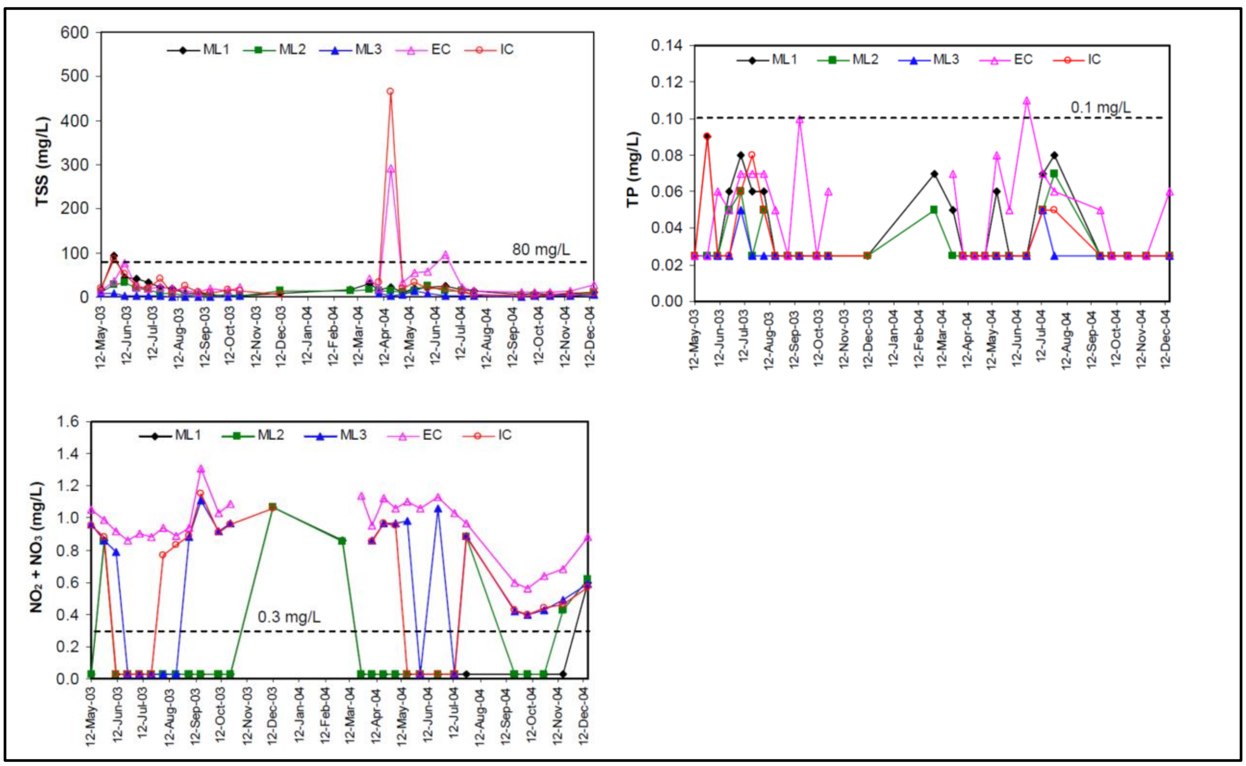


Figure 9. Suspended sediment and nutrient data from Medicine Lodge, Edie, and Irving Creeks, 2003–2004.

These data do not meet DEQ standards for assessment of beneficial uses but are provided to indicate trends in monitored streams.

2.3.1.2 Stream Temperature

The BLM Upper Snake Field Office monitored stream temperatures in 2008–2009 to evaluate the Yellowstone Cutthroat Trout rearing/migration maximum temperature of 22 ºC and spawning maximum temperature of 13 °C.

- East Fork Irving Creek: 6/18/2008–9/22/2008, zero exceedances
- West Fork Irving Creek: 5/30/2008–9/22/2008, zero exceedances
- Irving Creek below confluence: 5/30/2008–9/22/2008, zero exceedances
- Edie Creek: 5/30/2008–9/22/2008, zero exceedances of rearing/migration and 3 exceedances of spawning maximum
- Medicine Lodge Creek: 5/30/2008–9/22/2008, zero exceedances of rearing/migration and 39 exceedances of spawning maximum
- Warm Creek: 6/18/2008–10/11/2008, 9 exceedances of rearing/migration and 78 exceedances of spawning maximum
- Middle Creek: 6/14/2009–9/24/2009, zero exceedances of rearing/migration and 11 exceedances of spawning maximum

These unpublished data were not accompanied by location information, so it is not possible to associate it directly with specific AUs. Without accompanying metadata, the data do not meet DEQ standards for assessment of beneficial uses but are provided to indicate trends in monitored streams.

Due to budget limitations, DEQ has not collected any new stream temperature data since publication of the original TMDL (DEQ 2003). However, the data from the original TMDL are provided in Appendix C.

2.3.1.3 Bacteria Data

DEQ collected bacteria samples in accordance with the *Standard Operating Procedures for Sampling Escherichia coli in Surface Water* (DEQ 2012). Bacteria targets are set by Idaho's water quality standards (IDAPA 58.01.02.251). The numeric criterion for *Escherichia coli* (*E. coli*) is not to exceed 126 *E. coli* organisms per 100 milliliters (*E. coli*/100 mL) based on the geometric mean of five samples taken 3 to 7 days apart over a 30-day period. This criterion applies to both primary and secondary contact recreation. Table 5 provides the bacteria data collected for Medicine Lodge Creek in 2010, 2011, and 2013.

Table 5. *E. coli* bacteria concentrations in the Medicine Lodge Creek subbasin for 2010, 2011, and 2013.

Stream Name	Assessment Unit Number	Lat	Long	Designation	Sample Date	Concentration (cfu/100 mL)
			2010			
Warm Creek (i.e., Divide Creek)[a]	ID17040215SK013_03	44.46	-112.75	Secondary	6/22/2010	248.9
Warm Creek (i.e., Divide Creek)[a]	ID17040215SK013_03	44.46	-112.75	Secondary	7/20/2010	435.2
Warm Creek (i.e., Divide Creek)[a]	ID17040215SK013_03	44.46	-112.75	Secondary	8/24/2010	920.8
Warm Creek (i.e., Divide Creek)[a]	ID17040215SK013_03	44.46	-112.75	Secondary	9/27/2010	201.4
Irving Creek	ID17040215SK012_02	44.46	-112.62	Secondary	6/22/2010	3.1
Irving Creek	ID17040215SK012_02	44.46	-112.62	Secondary	7/20/2010	14.8
Irving Creek	ID17040215SK012_02	44.46	-112.62	Secondary	8/24/2010	14.6
Irving Creek	ID17040215SK012_02	44.46	-112.62	Secondary	9/27/2010	22.8
Middle Creek	ID17040215SK007_03	44.28	-112.45	Secondary	6/22/2010	22.82
Middle Creek	ID17040215SK007_03	44.28	-112.45	Secondary	7/20/2010	344.8
Middle Creek	ID17040215SK007_03	44.28	-112.45	Secondary	8/24/2010	166.9
Middle Creek	ID17040215SK007_03	44.28	-112.45	Secondary	9/27/2010	36.4
WF Indian Creek	ID17040215SK005_02	44.44	-112.41	Secondary	6/22/2010	387.3
WF Indian Creek	ID17040215SK005_02	44.44	-112.41	Secondary	7/20/2010	2,419.2
WF Indian Creek	ID17040215SK005_02	44.44	-112.41	Secondary	8/24/2010	2,419.2
WF Indian Creek	ID17040215SK005_02	44.44	-112.41	Secondary	9/27/2010	1,732.9
			2011			
Webber Creek	ID17040215SK017_02	44.36	-112.66	Secondary	8/24/2011	3.0
Warm Creek (i.e., Divide Creek)[a]	ID17040215SK013_03	44.46	-112.75	Secondary	9/13/2011	648.8
Warm Creek (i.e., Divide Creek)[a]	ID17040215SK013_03	44.46	-112.75	Secondary	9/20/2011	1,203.3
Warm Creek (i.e., Divide Creek)[a]	ID17040215SK013_03	44.46	-112.75	Secondary	9/27/2011	727.0
Warm Creek (i.e., Divide Creek)[a]	ID17040215SK013_03	44.46	-112.75	Secondary	10/4/2011	240.0
Warm Creek (i.e., Divide Creek)[a]	ID17040215SK013_03	44.46	-112.75	Secondary	10/11/2011	32.7
					Geometric mean	338.7

Stream Name	Assessment Unit Number	Lat	Long	Designation	Sample Date	Concentration (cfu/100 mL)
Edie Creek	ID17040215SK010_02	44.38	-112.61	Secondary	9/13/2011	43.5
Edie Creek	ID17040215SK010_02	44.38	-112.61	Secondary	9/20/2011	68.9
Edie Creek	ID17040215SK010_02	44.38	-112.61	Secondary	9/27/2011	185
Edie Creek	ID17040215SK010_02	44.38	-112.61	Secondary	10/4/2011	125.9
Edie Creek	ID17040215SK010_02	44.38	-112.61	Secondary	10/11/2011	63.8
					Geometric mean	85.1
Irving Creek	ID17040215SK012_02	44.46	-112.62	Secondary	9/13/2011	10.8
Irving Creek	ID17040215SK012_02	44.46	-112.62	Secondary	9/20/2011	73.3
Irving Creek	ID17040215SK012_02	44.46	-112.62	Secondary	9/27/2011	85.5
Irving Creek	ID17040215SK012_02	44.46	-112.62	Secondary	10/4/2011	56.5
Irving Creek	ID17040215SK012_02	44.46	-112.62	Secondary	10/11/2011	25.6
					Geometric mean	39.6
Middle Creek	ID17040215SK007_03	44.28	-112.45	Secondary	9/13/2011	1,413.6
Middle Creek	ID17040215SK007_03	44.28	-112.45	Secondary	9/20/2011	1,046.2
Middle Creek	ID17040215SK007_03	44.28	-112.45	Secondary	9/27/2011	870.4
Middle Creek	ID17040215SK007_03	44.28	-112.45	Secondary	10/4/2011	2,419.2
Middle Creek	ID17040215SK007_03	44.28	-112.45	Secondary	10/11/2011	325.5
					Geometric mean	1,002.7
Crooked Creek	ID17040215SK021_02	44.26	-112.72	Secondary	9/13/2011	30.9
Crooked Creek	ID17040215SK021_02	44.26	-112.72	Secondary	9/20/2011	36.8
Crooked Creek	ID17040215SK021_02	44.26	-112.72	Secondary	9/27/2011	49.6
Crooked Creek	ID17040215SK021_02	44.26	-112.72	Secondary	10/4/2011	32.3
Crooked Creek	ID17040215SK021_02	44.26	-112.72	Secondary	10/11/2011	152.9
					Geometric mean	48.9
			2013			
Webber Creek	ID17040215SK017_02	44.35	-112.66	Secondary	8/26/2013	57.3
Med Lodge Creek	ID17040215SK006_04	44.32	-112.56	Primary	8/26/2013	648.8
Med Lodge Creek	ID17040215SK006_04	44.32	-112.56	Primary	9/3/2013	980.4
Med Lodge Creek	ID17040215SK006_04	44.32	-112.56	Primary	9/9/2013	727.0
Med Lodge Creek	ID17040215SK006_04	44.32	-112.56	Primary	9/16/2013	218.7
Med Lodge Creek	ID17040215SK006_04	44.32	-112.56	Primary	9/23/2013	214.3
					Geometric mean	464.7

Stream Name	Assessment Unit Number	Lat	Long	Designation	Sample Date	Concentration (cfu/100 mL)
Middle Creek	ID17040215SK007_03	44.34	-112.48	Secondary	8/21/2013	980.4
Middle Creek	ID17040215SK007_03	44.34	-112.48	Secondary	8/26/2013	1,299.7
Middle Creek	ID17040215SK007_03	44.34	-112.48	Secondary	9/3/2013	1,299.7
Middle Creek	ID17040215SK007_03	44.34	-112.48	Secondary	9/9/2013	1,553.1
Middle Creek	ID17040215SK007_03	44.34	-112.48	Secondary	9/16/2013	1,119.9
					Geometric mean	1,235.6

a. According to the 2010 Integrated Report, bacteria sampling for Divide Creek (ID17040215SK014_02) was collected downstream in what the Integrated Report calls Warm Creek AU (ID17040215SK013_03) where there was water.
Note: Colony forming units (cfu) per 100 milliliter sample

Exceedances of the geometric mean of five samples taken 3 to 7 days apart over a 30-day period occur for the following:

- Warm Creek (i.e., Divide Creek)—ID17040215SK013_03 (**Note**: According to the 2010 Integrated Report, bacteria sampling for Divide Creek (ID17040215SK014_02) was collected downstream in the Warm Creek AU (ID17040215SK013_03) where there was water.
- Middle Creek—ID17040215SK007_03
- Medicine Lodge Creek—ID17040215SK006_04

Sampling for West Fork Indian Creek (ID17040215SK005_02) did not follow the protocol for calculating compliance with the water quality standard and only four samples rather than five were taken. However, even if the fifth sample was near zero concentration, the geometric mean would still equal 208 colony forming units/100 mL (cfu/100 mL), so an *E.coli* TMDL will be completed for West Fork Indian Creek.

2.3.2 Bioassessment Data

The DEQ Assessment Database compiles bioassessment data that have been collected statewide from 1994 through 2013. Analyzing the habitat condition and populations of macroinvertebrates and fish is the most efficient and cost-effective means of determining long-term water quality in streams. Diversity of species, existence of species that have a low tolerance to water quality impairments, and size of populations are just a few of the measures that demonstrate support status of beneficial uses. Barbour, et al. (1999) provides more information about bioassessment protocols that identify water quality characteristics. The Medicine Lodge Creek subbasin has been extensively monitored for beneficial use support status through such bioassessment protocols (Figure 10). The yellow symbols indicate that the streambed was dry during the field visit by Beneficial Use Reconnaissance Program (BURP) crews, so no data are associated with these locations. The blue symbols indicate the year the stream was monitored.

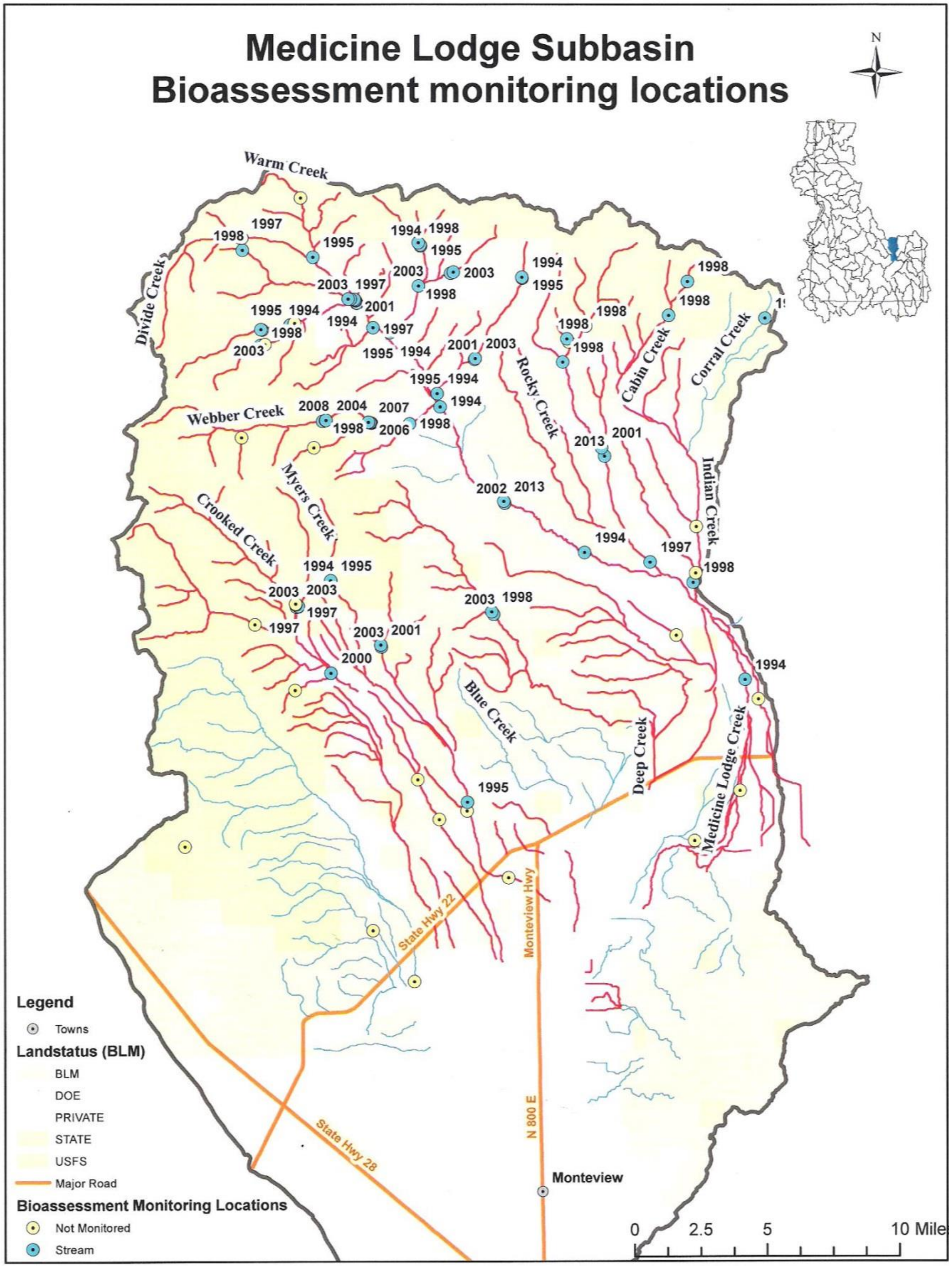


Figure 10. BURP monitoring locations in Medicine Lodge Creek subbasin.

Out of 42 stream locations monitored since publication of the original TMDL, only seven streams had any water in the channel and had macroinvertebrate and fish data collected. Table 6 provides the multimetric index scores and average condition ratings for this bioassessment monitoring data.

Table 6. Multimetric index scores and average condition ratings in the Medicine Lodge Creek subbasin since 2003.

Stream Name	Assessment Unit Number	Year Sampled	SMI[a]	SFI[b]	SHI[c]	Multimetric Index Score	Average Condition Rating
East Fork Irving Creek	ID17040215SK012_02	2003	2	0	2	0	Fail
Irving Creek	ID17040215SK012_03	2003	3	2	2	2.33	Pass
Warm Springs Creek	ID17040215SK020_02	2003	1	0	1	0	Fail
Myers Creek	ID17040215SK021_02	2003	1	1	1	1.0	Fail
Crooked Creek	ID17040215SK021_02	2003	1	ND[d]	2	1.5	Fail
Webber Creek	ID17040215SK017_02	2003	3	3	2	2.67	Pass
Webber Creek (2004SDEQA023)	ID17040215SK017_02	2004	3	1	3	2.33	Pass
Webber Creek (2004SIDFA038)	ID17040215SK017_02	2004	1	ND[d]	1	1.0	Fail
Webber Creek	ID17040215SK017_02	2005	2	2	3	2.33	Pass
Webber Creek	ID17040215SK017_02	2006	3	2	2	2.33	Pass
Webber Creek	ID17040215SK017_02	2007	3	3	1	2.33	Pass
Webber Creek	ID17040215SK017_02	2008	1	2	3	2.0	Pass
Webber Creek	ID17040215SK017_02	2011	2	3	2	2.33	Pass

a. Stream Macroinvertebrate Index—score based on seven different qualities of macroinvertebrates found at a sampling location, including species diversity, richness, and guilds, and pollution tolerance
b. Stream Fish Index—score based on fish species present, abundance of the different species, and presence/absence of juveniles
c. Stream Habitat Index—measures of stream habitat such as substrate composition, channel structure, streamside vegetation, and streambank condition
d. No data

2.3.3 Sediment Data and Analysis of Combined Biota/Habitat Bioassessment Impairments

DEQ investigated the AUs listed for sediment and combined biota/habitat bioassessment in this subbasin. When sediment was added to the various Integrated Report cycles, it was sometimes based on field audits by BLM that do not necessarily mean excess sediment load to the streams. DEQ conducted a number of streambank erosion inventories (SEIs) because of its likely potential source or pathway for excess sediment (Appendix D). The following streams received SEIs to determine the extent of sediment load:

- Medicine Lodge Creek—ID17040215SK006_04
- Middle Creek—ID17040215SK007_02 and ID17040215SK008_02
- Dry Creek—ID17040215SK009_02
- Edie Creek—ID17040215SK010_02
- Irving Creek—ID17040215SK012_02 and ID17040215SK012_03

- Warm Creek—ID17040215SK013_02
- Divide Creek—ID17040215SK014_02
- Horse Creek—ID17040215SK015_02
- Deep Creek—ID17040215SK018_02 and ID17040215SK018_03
- Crooked Creek—ID17040215SK021_02

Where sediment is the stressor to water quality, complex interrelationships exist between the flow of water, movement of sediment, and mobile boundaries of the stream (Leopold et al. 1995). The physics of fluid force and fluid stresses; mass density of individual sediment grains and solid stresses; frictional forces; inclination angle of the streambed; transport power as a function of force, distance and time describe the potential for any given sediment particle to be transported. Leopold et al. (1995) provides a ratio showing that as

$$\frac{\text{available bedload power}}{\text{available suspended-load power}}$$

becomes smaller, the bigger the river. Additional research (Wohl 2000) shows that bedload composes a much higher proportion of the total sediment load than suspended sediment in high-gradient streams. Bedload is also more important in forming and changing the channel of a mountain stream. Wohl (2000) goes on to show that bedload transport varies due to differential erosion and deposition associated with bedform sequences and the frequency of bedload movement is a function of hydrologic driving forces and channel resisting forces (Wohl 2000).

The basaltic and granitic parent geology in the Medicine Lodge Creek subbasin breaks down into heavier particles that tend to contribute to bedload rather than suspended sediment. In these higher-gradient mountain streams, baseflow does not have the power to transport these particles. As shown in Wohl (2000) for high-relief streams in dry climates, similar to the 1st-, 2nd-, and 3rd-order streams that are listed in the Medicine Lodge Creek subbasin, only high-magnitude, low-frequency flow have the force to transport bedload sediment.

DEQ collected streambank data according to the protocol, *Standard Operating Procedures for Streambank Erosion Inventory to Measure Instream Stability and Estimate Annual Sediment Loads in Wadeable Streams* (DEQ 2014b).

SEI methods are applicable where excess sediment is the result of instream erosion, as opposed to overland erosion due to land use. Beneficial uses of cold water aquatic life and salmonid spawning are impaired by eroding streambanks when the excess sediment settles into the bedload of a stream channel and restricts or removes habitat. Most of the northern third of Medicine Lodge Creek subbasin—the portion that contains perennial waters—is used for rangeland with some undeveloped recreational access points so the listed AUs were investigated for streambank stability.

The SEI method includes field techniques and data analysis that uses eroding streambank measurements to calculate the sediment load that is conveyed by the stream, generally during bankfull events. Streambanks are surveyed for eroding area, lateral recession rate, and soil properties. These features go into the following calculation:

$$E = [A_E*R_{LR}*\Delta_B]/2{,}000 \text{ lb/ton}$$

where:

E = bank erosion rate (tons/year)
A_E = eroding area (ft^2)
R_{LR} = lateral recession rate (ft/yr)
Δ_B = bulk density of bank material (lb/ft^3)

The calculation for the current sediment load is compared to the assumed natural background condition. For initial implementation purposes, natural background erosion rates are assumed to be achieved at 80% streambank stability, which equates with the load capacity. The difference between the current sediment load and load capacity equals the necessary load reduction. If the current sediment load is less than or equal to the load capacity, there is no load reduction needed because the 80% streambank stability target has been reached. SEI is a cost-effective method for calculating sediment loads from instream erosion, but it is also useful for targeting the highest priority areas for implementation efforts. Maps of the monitoring locations, pictures, and the worksheets used to calculate potential sediment loads are provided in Appendix D. A summary of the results for each AU is provided in section 2.3.5.

DEQ investigated the AUs listed for combined biota/habitat bioassessments or sediment in 2011 and 2012 for potential impacts from eroding streambanks caused by excess livestock trampling, road crossings, or unimproved recreational uses. There are few other potential sediment sources in the AUs identified as impaired. The croplands are lower in the subbasin where there are little or no natural streams, so overland runoff is not a likely potential source. For the AUs listed for combined biota/habitat bioassessment, section 2.3.5 provides a summary of the investigation of potential causes for impairment.

2.3.4 Shade Data

DEQ investigated streams identified in the original temperature TMDL (DEQ 2003) for current and target effective shade levels to revise the TMDL methods and to aid in implementing watershed improvement efforts. The streams with excess heat loads due to lack of shade are allocated load reductions. The present analysis revises the previous EPA-approved temperature TMDLs. DEQ has replaced the 2003 temperature TMDL with the PNV methodology that uses shade as a surrogate for temperature as part of this TMDL and 5-year review. Revised temperature analyses are established according to Idaho’s PNV methods (Shumar and de Varona 2009). This shade analysis is provided in Section 5.1, “Temperature TMDLs.”

Portions of AUs in the shade analysis were identified as ephemeral waters through aerial photo interpretation and field verification. Two types of ephemeral waters were discovered: those with channels indicating water movement during the snowmelt period (Figure 11), and those with no channel suggesting water has not been there for some years (Figure 12). These areas are contrasted with small perennial waters where occupied channels are clearly visible (Figure 13).

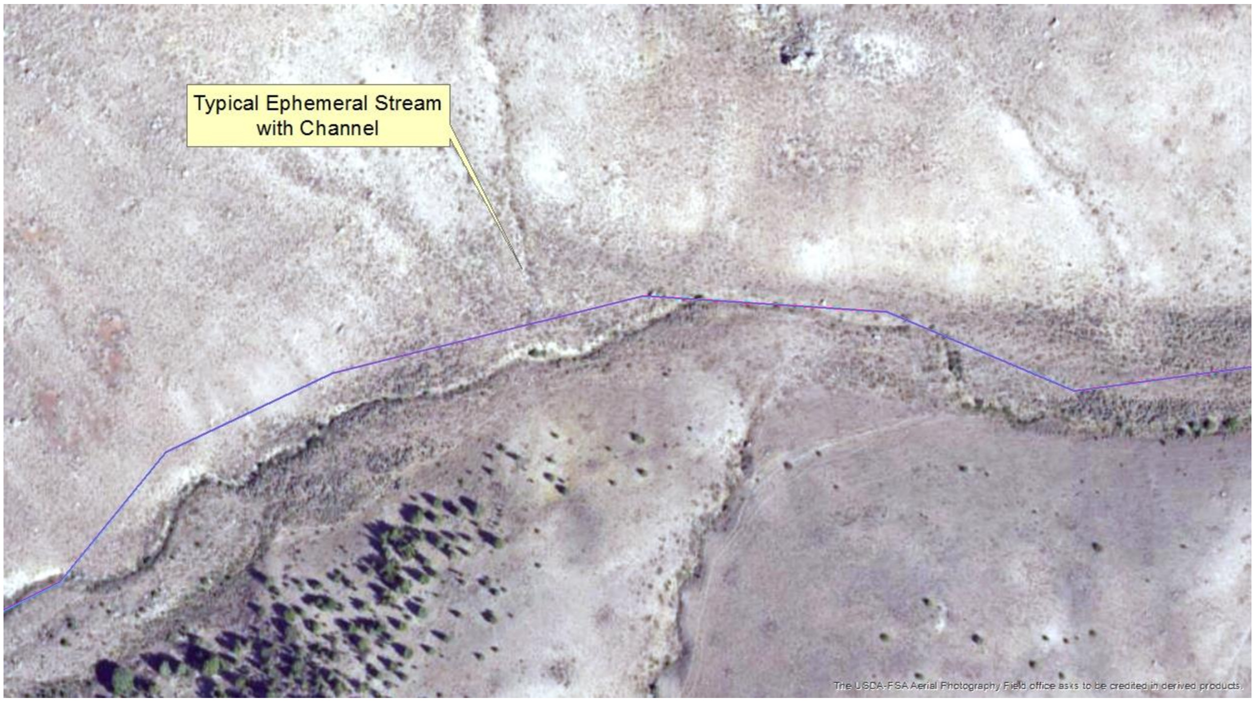


Figure 11. Ephemeral stream with channel indicating water movement during snowmelt period in the Medicine Lodge Creek subbasin (1:2000).

Figure 12. Ephemeral drainage without channel indicating a lack of water in the Medicine Lodge Creek subbasin (1:2000).

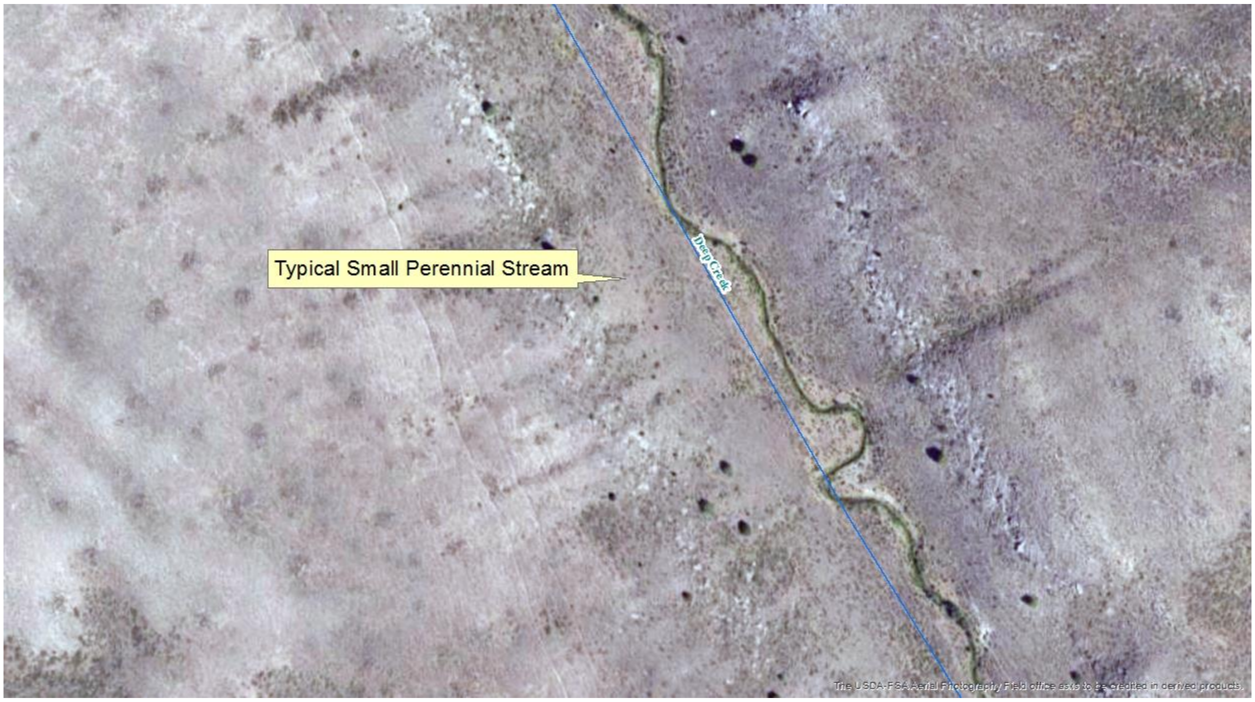


Figure 13. Small perennial stream with occupied channels in the Medicine Lodge Creek subbasin (1:2000).

2.3.5 Assessment Unit Summary

A summary of the data analysis, field investigations, and a list of conclusions for each AU included in Category 5 of the 2012 Integrated Report is provided below. Each summary recommends changes to the next Integrated Report once the TMDLs in this document have been approved by EPA.

West Fork Indian Creek—source to mouth (ID17040215SK005_02)

West Fork Indian Creek is a small watershed at the headwaters of Indian Creek on the east side of the subbasin. The AU includes Cabin Creek, a tributary to West Fork Indian Creek and numerous unnamed 1st-order drainages.

Chronological Assessment History

- 1994 §303(d) list—Not listed.
- 1996 §303(d) list—Not listed.
- 1998 BURP data—Not fully supporting cold water aquatic life and salmonid spawning. Both sites showed surface fines less than 21%. BURP results are very unusual; both Cutthroat Trout and Sculpins were caught, and riparian condition is currently very good with extensive willow growth.
- 1998 §303(d) list—Not listed.
- 2002 Integrated Report—Listed in Category 5 for unknown and pathogens. *E. coli* geometric mean = 205. Not fully supporting secondary contact recreation (likely 1998 sampling). Unknown was likely a place holder for failure of combined biota/habitat bioassessments used in subsequent Integrated Reports.

- 2008 Integrated Report—Listed in Category 5 for combined biota/habitat bioassessments to replace the unknown pollutant and fecal coliform.
- 2010 Integrated Report—Listed in Category 5 for combined biota/habitat bioassessments and *E. coli*.
- 2011 bacteria sampling—*E. coli* geometric mean = 714.2.
- 2012 Integrated Report—Listed in Category 5 for combined biota/habitat bioassessments and *E. coli*.

The BURP sites used in the previous assessment that resulted in a combined biota/habitat bioassessment impairment are 1998SIDFA039—a 1st-order stream and 1998SIDFA040—a 2nd-order stream. Although one site had passing scores, its macroinvertebrate scores were low, and the other site did not pass. The assessments that caused this AU to be listed are shown in Table 7.

Table 7. BURP assessments leading to combined biota/habitat bioassessment impairment for West Fork Indian Creek (ID17040215SK005_02).

Burp ID	Stream	SMI Score	SMI Rating	SMI BioRegion	SFI Score	SFI Rating	SFI BioRegion	SHI Score	SHI Rating	SHI BioRegion	Average
1998SIDFA039	West Fork Indian Creek	48.61	1.00	Cent&So Mtns	85.26	3.00	Forested	54.00	1.00	No. Rockies	1.67
1998SIDFA040	West Fork Indian Creek	42.55	1.00	Cent&So Mtns	78.33	2.00	Forested	69.00	3.00	No. Rockies	2.00

Notes: Stream Macroinvertebrate Index (SMI); Stream Fish Index (SFI); Stream Habitat Index (SHI)

Although the original bioassessment work took place in 1998, no further assessments have been made. No SEI was conducted in the AU. This addendum contains a bacteria TMDL to address the *E. coli* listing; however, there has been no further work to address the combined biota/habitat bioassessment listing. The AU will remain in Category 5 for combined biota/habitat bioassessments until future assessments can be established.

Medicine Lodge Creek (ID17040215SK006_04)

This AU of Medicine Lodge Creek includes the middle portion of the mainstem from Webber Creek to Indian Creek. Three BURP sites are located within this AU, ranging in age from 1994, 2002 to 2013. Two of the three years showed failing bioassessment scores: low fish and habitat scores in 1994 and low macroinvertebrate and fish scores in 2013. Although scores were passing in 2002, macroinvertebrate scores were still low. TMDLs for sediment and temperature were completed and approved in 2003. The current investigations are to update the temperature TMDL and assess the progress of the sediment TMDL.

A map and photo of the SEI monitoring location for Medicine Lodge Creek, ID17040215SK006_04 are shown in Figure 14 and Figure 15. Assessment efforts have focused on an area of Medicine Lodge Creek typical of the lower canyon. DEQ found no evidence of eroding streambanks in this portion of Medicine Lodge Creek. Lateral recession rate scoring was not greater than expected, and the amount of erosive bank was not greater than the 20% threshold typical of natural bank stability estimates.

As shown on the SEI calculations in Appendix D, out of 933 meters of streambank inventoried, 1.6% exhibited erosion, and this can be extrapolated to 13,260 meters of similar stream. The results are a total sediment load of 1.4 tons per year, which is less than the assimilative load capacity of 152.7 tons per year. A McNeil core depth fine sample was taken just upstream from the SEI reach. Mean depth fines (without 2.5-inch particles) were 21%, which is less than the 28%–33% maximum expected under natural conditions. Surface fine data from the pebble counts at the 2013 BURP site were 11% or less. Sediment impairment above natural background is not present in this stream segment.

Medicine Lodge Creek (ID17040215SK006_04) currently has an approved sediment TMDL (DEQ 2003). Results of analyses for excess sediment showed that sediment impairment may be decreasing for the middle Medicine Lodge Creek AU. Because the stream has an existing sediment TMDL, no new action is required. Further investigation is needed in other parts of Medicine Lodge Creek to determine the extent of progress towards eliminating the sediment impairment in this system. This addendum contains a bacteria TMDL to address the *E. coli* listing.

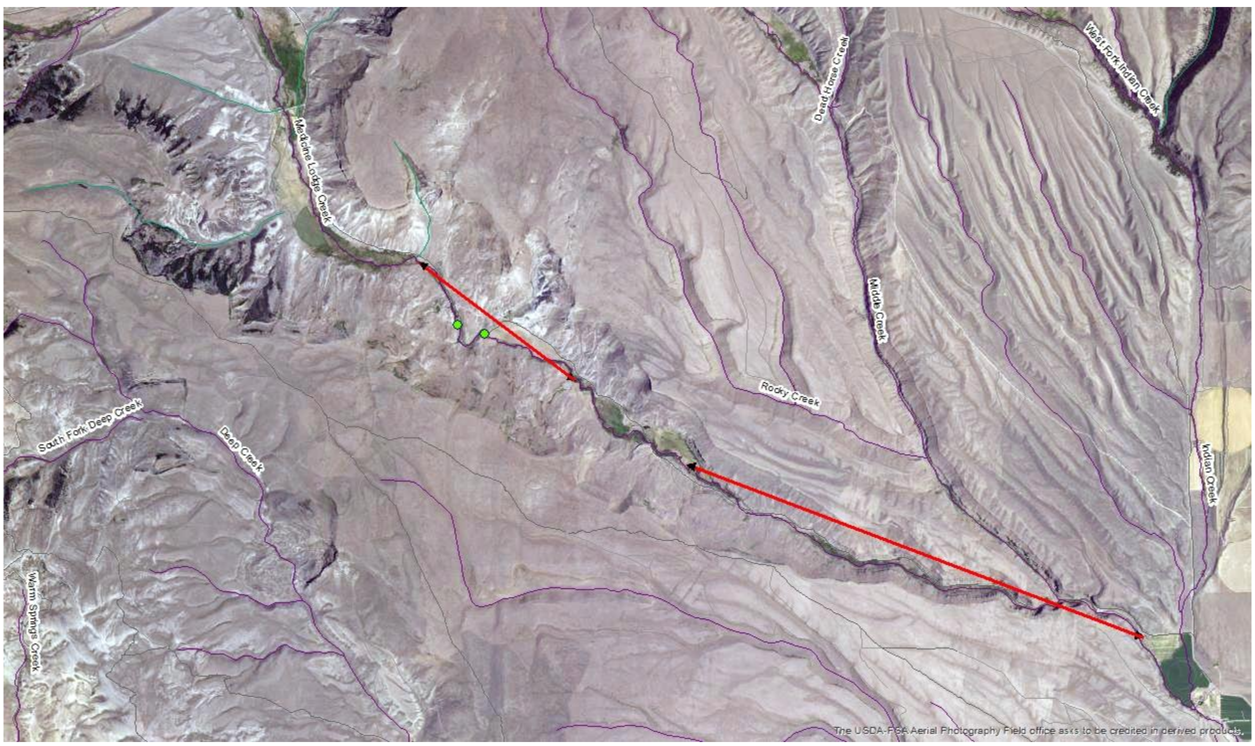


Figure 14. Map of the monitoring locations (between green dots) for Medicine Lodge Creek (ID17040215SK006_04). Length of similar stream is shown with red line.

Figure 15. Sediment monitoring location for Medicine Lodge Creek (ID17040215SK006_04).

Middle Creek (ID17040215SK007_02)

This AU includes the lower portion of the 2nd-order Middle Creek below Dry Creek. The upper portion is within ID17040215SK008_02. ID17040215SK 007_02 also includes Rocky Creek, Dead Horse Creek, and several unnamed tributaries.

Chronological Assessment History

- 1994 §303(d) list—Not listed.
- 1996 §303(d) list—Not listed.
- 1998 §303(d) list—Not listed.
- 2002 Integrated Report—Listed in Category 3 for not assessed.
- 2003 TMDL—Temperature was identified as a pollutant, and a temperature TMDL was written for this AU.
- 2008 Integrated Report—Listed in Category 4a for approved temperature TMDL and Category 5 for sediment.
- 2010 Integrated Report—Listed in Category 4a for approved temperature TMDL and Category 5 for sediment.
- 2012 Integrated Report—Listed in Category 4a for approved temperature TMDL and Category 5 for sediment.

No BURP sites exist in this AU; however, one site is directly below ID17040215SK007_03. Temperature monitoring presented in the 2003 TMDL showed temperature impairment, and a temperature TMDL was provided. It is unknown why sediment was added as a cause in 2008, as indicated in the assessment database comments. DEQ visually inspected the AU in 2011 and 2012 and suggested that this AU is not impaired for sediment. However, no sediment monitoring has taken place within the AU. This TMDL addendum and 5-year review provides a temperature TMDL based on PNV to replace the earlier mass balance method.

SEI and percent fines data, either as core depth fines or surface pebble counts need to be gathered before this AU is adequately assessed for sediment, and the AU needs further bioassessments (BURP monitoring). The AU should be delisted for sediment in the next Integrated Report until such investigations are completed.

Middle Creek (ID17040215SK007_03)

This AU is located directly downstream of ID17040215SK007_02 (Figure 16). Figure 17, photos 7 and 8 shows the BURP sites. The AU also contains two other BURP sites, one from 2001 and one from 2013.

Chronological Assessment History

- 1994 §303(d) list—Not listed
- 1996 §303(d) list—Not listed
- 1997 BURP location—Lowest site in the AU. Not fully supporting cold water aquatic life or secondary contact recreation uses (*E. coli* = 396 geometric mean). Pebble count data for this site averaged 15% surface fines.
- 1998 §303(d) list—Not listed
- 2001 BURP location—Not fully supporting cold water aquatic life. This bacteria sample did not exceed standards; it was higher in the watershed than the 1997 BURP site. Pebble count data for this site average 30% surface fines.
- 2003 TMDL—Temperature was identified as a pollutant and a temperature TMDL was written for this AU. (Bacteria was not addressed at this time because this TMDL was based on the 1998 list, which did not have pathogens as a cause.)
- 2002 IR—Listed in Category 5 for unknown and pathogens.
- 2008 IR—Listed in Category 5 for fecal coliform. Due to an oversight by DEQ, this AU was not included in Category 4a as having an EPA-approved TMDL for temperature from the 2003 TMDL. The 2003 TMDL (Table A on page xix) shows this AU under the temperature load allocations.
- 2010 Integrated Report—Listed in Category 5 for fecal coliform but still not in Category 4a for temperature.
- 2011 bacteria sampling—*E. coli* geometric mean = 1002.7.
- 2012 Integrated Report—Listed in Category 5 for fecal coliform and Category 4a for temperature.
- 2013 BURP location—Pebble count data for this site average 29% surface fines.

This TMDL addendum and 5-year review provides a revised temperature TMDL based on PNV to replace the earlier mass balance method and a new *E. coli* TMDL. This AU will be delisted from Category 5 for fecal coliform and listed in Category 4a for temperature and *E. coli* TMDLs.

Figure 17, photos 7 and 8 are taken at the location of BURP site 2001SIDFA052 in the 3rd-order AU. The BURP site is located about 300 yards downstream of an unimproved ford. The stream is otherwise mostly stable and vegetated within its bankfull width in a geologically terraced valley. Upstream of this ford and an allotment fence, the stream is densely vegetated. Downstream of the BURP site, the floodplain is within a natural terrace. The streambanks are vegetated and stable—the few eroding areas measured were a result of the natural sinuosity of the channel.

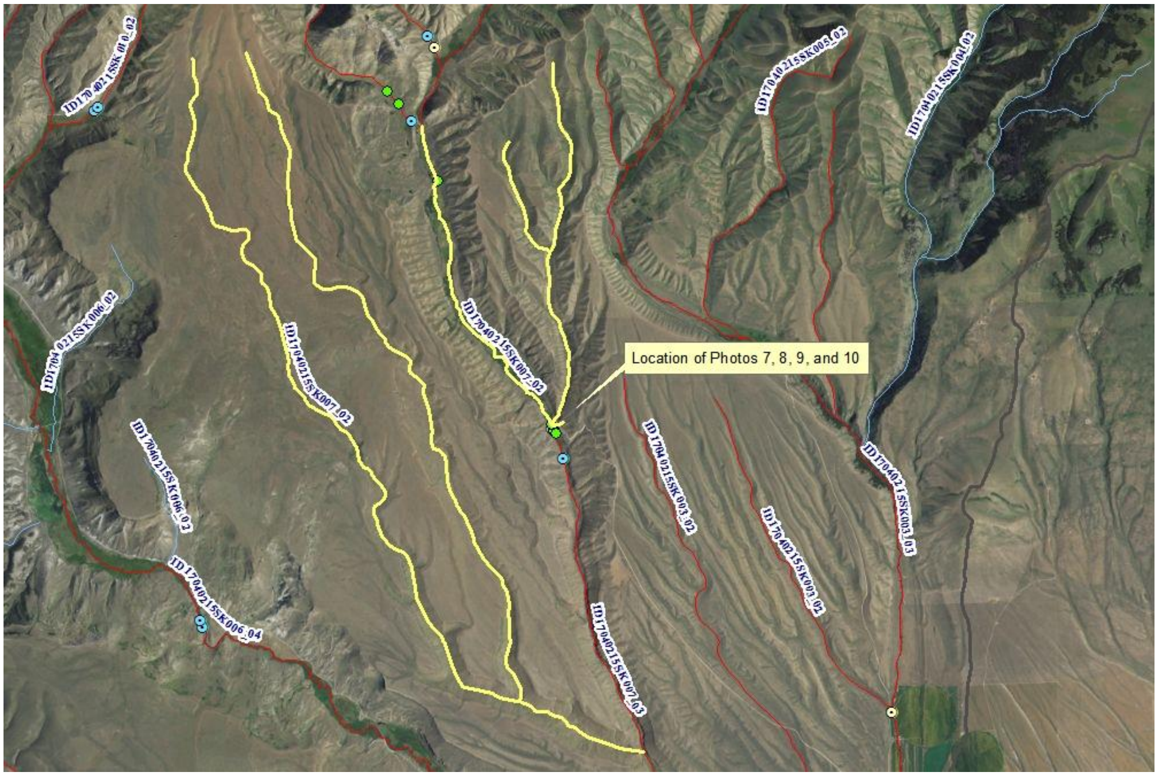


Figure 16. Map of monitoring locations (photos 7, 8, 9, and 10) for downstream portion of Middle Creek (ID17040215SK007_03).


Photo 7

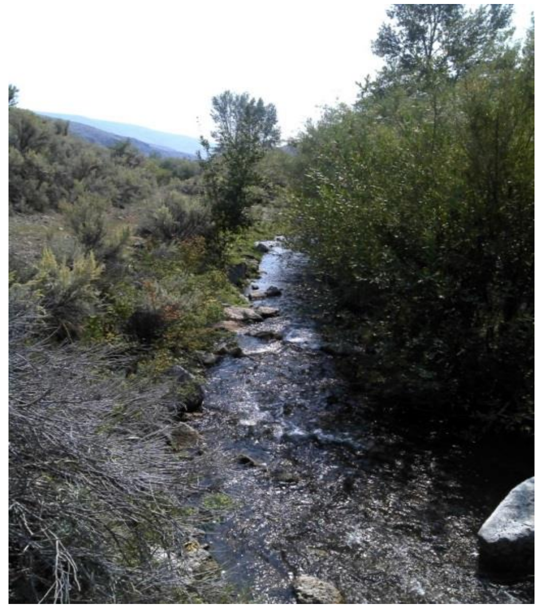


Photo 8


Photo 9


Photo 10

Figure 17. Sediment monitoring locations for downstream portion of Middle Creek (ID17040215SK007_03).

Middle Creek (ID17040215SK008_02)

This AU of Middle Creek is upstream of the ID17040215SK007_02 unit and includes the upper most reaches of Middle Creek as well as Poison Creek and several unnamed tributaries.

Chronological Assessment History

- 1994 §303(d) list—Not listed.
- 1996 §303(d) list—Not listed.
- 1998 §303(d) list—Not listed.
- 1998 BURP locations—Not fully supporting cold water aquatic life. The site appeared to have eroding banks and other signs of heavy grazing. However, pebble count data for this site was 12% or less surface fines. A second 1998 BURP site was located on Wood Canyon, a lower tributary within this AU. Pebble count data for this site averaged 53% surface fines.
- 2002 Integrated Report—Listed in Category 5 for sediment due to field audits with BLM.
- 2003 TMDL—Temperature was identified as a pollutant, and a temperature TMDL was written for this AU.
- 2007 BURP location—This site was to be in the same Wood Canyon location as the 1998 site; however, it is now fenced off and posted as private property. No access = no data.
- 2008 Integrated Report—Listed in Category 4a for temperature and Category 5 for sediment.
- 2010 Integrated Report—Listed in Category 4a for temperature and Category 5 for sediment.
- 2011 and 2012 DEQ investigations—Showed this AU may not impaired for sediment.
- 2012 Integrated Report—Listed in Category 4a for temperature and Category 5 for sediment.

Temperature data presented in the 2003 TMDL showed temperature impairment and a temperature TMDL was provided. This TMDL addendum and 5-year review provides a temperature TMDL based on PNV to replace the earlier mass balance method.

A map and photos of the sediment monitoring locations for upper Middle Creek (ID17040215SK008_02) are shown in Figure 18 and Figure 19. In upper Middle Creek, fencing has successfully excluded cattle. Mature bunch grasses and large cottonwoods exist in the riparian area. Cattle are kept out of the riparian area with off-site watering. Streambanks are armored and abundant woody debris is available in the channel. There were no eroding streambanks to measure.

As shown on the SEI calculations for ID17040215SK008_02 in Appendix D, out of 713 meters of streambank inventoried, only 0.4% exhibited erosion. This was extrapolated to 4,490 meters of similar stream in the unit. The erosion results in a total sediment load of 0.1 tons per year, which is less than the assimilative load capacity of 7.3 tons per year. Sediment impairment from bank erosion is not present in this stream segment. A McNeil core sample for depth fines was taken at a location 250 meters below Poison Creek confluence (photo location in Figure 18). Mean depth fines (without 2.5-inch particles) were 38% suggesting that fine material is still higher than expected (greater than 28%–33% natural limits) deeper in the gravels. Hopefully fines will decrease with time as they are flushed out of the system. These data are inconclusive about sediment conditions within the AU. While the core fines results suggest excess sediment in the system, it does not appear to be coming from streambanks locally. Further work must be done upstream of this location before assessment can be completed. Additionally, the AU needs current bioassessment since the last assessments were based on 1998 data. It is recommended that this AU is listed in Category 4a for temperature TMDL and remain listed in Category 5 for sediment.

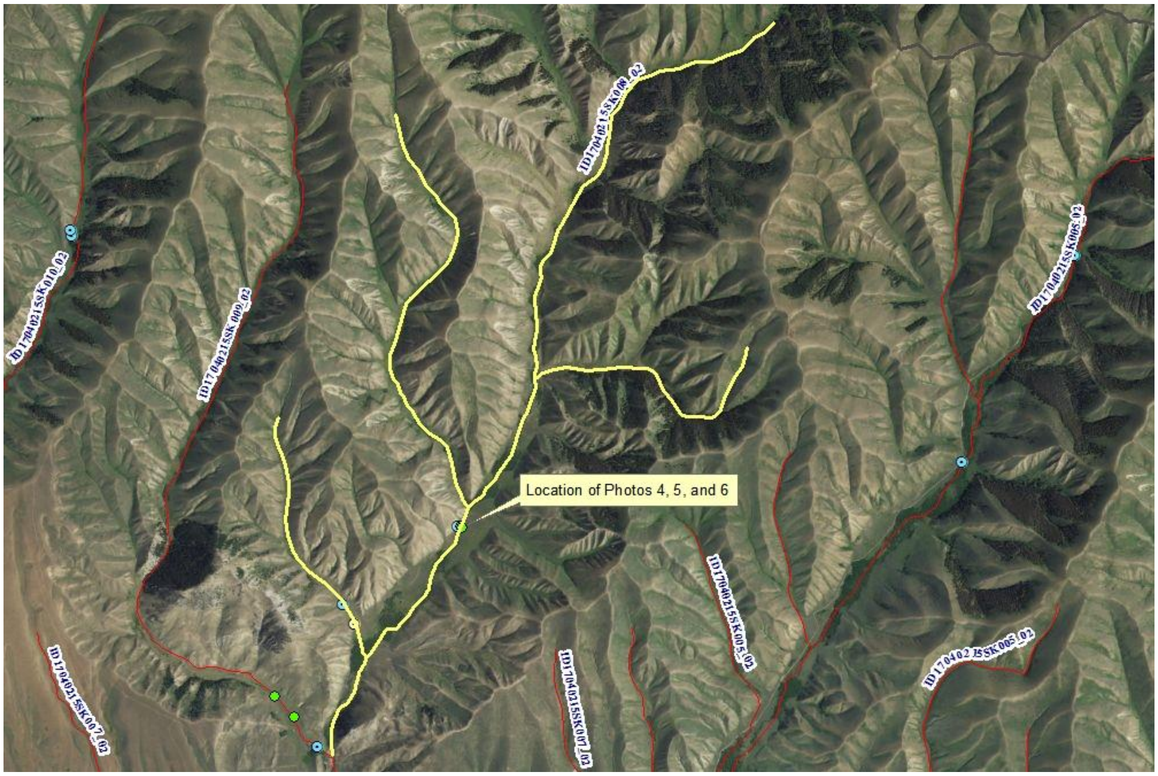


Figure 18. Map of monitoring locations (photos 4, 5, and 6) for upper Middle Creek (ID17040215SK008_02).

Photo 4

Photo 5

Photo 6

Figure 19. Sediment monitoring locations for upper Middle Creek (ID17040215SK008_02).

Dry Creek (ID17040215SK009_02)

Dry Creek is a tributary to Middle Creek, entering at a location that defines the boundary between ID17040215SK008_02 and ID17040215SK007_02 of Middle Creek.

Chronological Assessment History

- 1994 §303(d) list—Not listed.
- 1996 §303(d) list—Not listed.
- 1998 §303(d) list—Not listed.
- 1998 BURP location—Not fully supporting cold water aquatic life. The site had evidence of past bank erosion; however, pebble count data for this site averaged 18% surface fines.
- 2002 Integrated Report—Listed in Category 5 for sediment due to field audits with BLM.

- 2003 TMDL—AU was not included in the 2003 TMDL.
- 2008 Integrated Report—Listed in Category 5 for sediment.
- 2010 Integrated Report—Listed in Category 5 for sediment.
- 2011 and 2012 DEQ investigations—Showed this AU may not be impaired for sediment.
- 2012 Integrated Report—Listed in Category 5 for sediment.

A map and photo of the 2011 sediment monitoring location for Dry Creek (ID17040215SK009_02) are shown in Figure 20 and Figure 21. Dry Creek is entirely in a 1st-order channel, although DEQ lumps all 1st- and 2nd-order streams into a single AU designation. The sediment monitoring location is upstream of the BURP site, 1998SIDFA048. Potential impacts are a road following the stream about 30 meters away and occasional grazing. The stream is completely stable and vegetated within its bankfull width in a geologically terraced valley. At the original BURP location, the terrace was on the right bank (viewing downstream) ranging from 5–8 meters away from the wetted channel, which exhibited stable sinuosity. The 2011 DEQ streambank investigation determined that there were no impairments to the streambanks.

As shown on the SEI calculations in Appendix D, out of 658 meters of streambank inventoried, only 3.1% exhibited erosion from adjacency to the road. The inventory results can be extrapolated to 8,375 meters of similar stream. This results in a sediment load of 2.4 tons per year, which is less than the assimilative load capacity of 20.7 tons per year. Sediment impairment from bank erosion is not present in this stream segment.

The low bioassessment score associated with the 1998 BURP site was due to low taxa diversity in the macroinvertebrates, but the population was high. Low taxa diversity can be expected in low-flow 1st-order streams in a dry habitat. Further work is needed via pebble counts or cores to determine the nature and extent of fine sediments in this AU before conclusions can be drawn. Additionally, this AU needs to receive current bioassessments to determine if conditions have changed since 1998. This AU was listed in Category 5 for sediment; however, there are strong indications that it is a candidate for delisting due to low sediment impacts. It should be moved to Category 2.

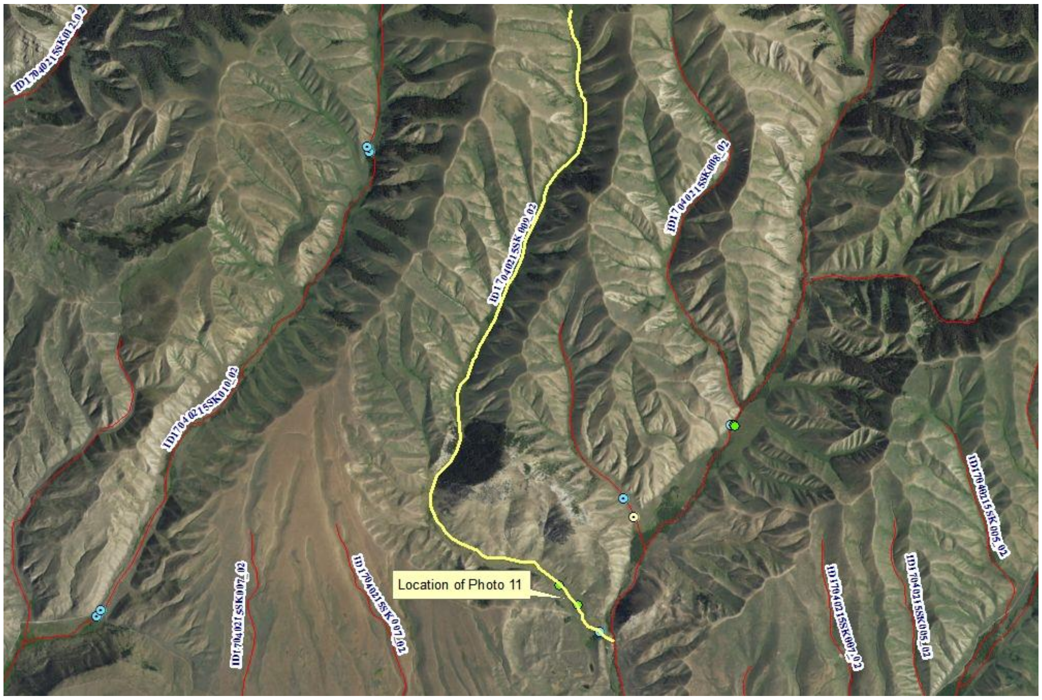


Figure 20. Map of monitoring location (photo 11) for Dry Creek (ID17040215SK009_02).

Photo 11

Figure 21. Sediment monitoring location for Dry Creek (ID17040215SK009_02).

Edie Creek (ID17040215SK010_02)

This AU is a 2nd-order watershed tributary to Medicine Lodge Creek just above the central valley section.

Chronological Assessment History

- 1994 §303(d) list—Listed for sediment, habitat alteration, nutrients; referencing §305(b) Appendix D of 1992 water quality status report.
- 1994 and 1995 BURP sites—Not fully supporting cold water aquatic life and salmonid spawning. Four sites were monitored in these 2 years: two sites in the headwaters and two sites near the mouth of Edie Creek. The headwater sites showed very little surface fines with counts averaging 11%. The lower sites were much different with pebble counts averaging 53% surface fines.
- 1996 §303(d) list—Listed for sediment, habitat alteration, nutrients; referencing §305(b) Appendix D of 1992 water quality status report.
- 1998 §303(d) list—Listed for habitat alteration, nutrients, and sediment.
- 2001 and 2003 BURP sites—Showed exceedance of instantaneous bacteria criterion. This location is more midway in the watershed. The 2001 pebble count data averaged 41% surface fines. The 2003 site visit had too low flow (<1 cfs) for sampling.
- 2002 Integrated Report—Listed in Category 4c for habitat alteration and Category 5 for sediment.
- 2003 TMDL—Found no nutrient impairment; found temperature and sediment impairment and provided TMDL load allocations for both.
- 2008 Integrated Report—Not listed in the 2008 Integrated Report. AU should have been listed in Category 4a for temperature and sediment. **Note**: This AU is listed in the 2008 Integrated Report under "Delisted Assessment Units" (page 158) as having an approved sediment TMDL, but the temperature TMDL was not mentioned.
- 2010 Integrated Report—Listed in Category 4a for sediment and Category 5 for *E. coli*. The AU should have also been listed in Category 4a for temperature.
- 2011 and 2012 DEQ investigations—Showed this AU was not impaired for bacteria (section 2.3.1.3), and sediment conditions are still above targets but may be improving. A PNV temperature load allocation has been calculated to replace the earlier mass balance temperature approach (section 5).
- 2014 BURP site—This site, slightly upstream of the 2001/2003 locations, also had very low flow (<1 cfs) but was sampled this time. Pebble count data for this site averaged 16% surface fines. When these data are analyzed for bioassessment purposes in the future, progress towards meeting standards can be more fully addressed.

A map and photos of the monitoring locations for Edie Creek (ID17040215SK010_02) are shown in Figure 22 and Figure 23. Assessment efforts have been focused on the area of the middle of Edie Creek. DEQ found evidence of eroding streambanks in Edie Creek. Although the stream is small, and the amount of erosive bank is under the 20% threshold typical of natural bank stability estimates, lateral recession rate scoring was sufficiently greater than expected to create a sediment load that slightly exceeded load capacity.

As shown on the SEI calculations in Appendix D, out of 945 meters of streambank inventoried, 18.9% exhibited erosion, and this can be extrapolated to 4,590 meters of similar stream. The results are a total sediment load of 83.6 tons per year, which is greater than the assimilative load capacity of 83.1 tons per year. Slight sediment impairment above natural background is present in this stream. Edie Creek (ID17040215SK010_02) currently has an approved sediment TMDL (DEQ 2003). Results of analyses for excess sediment showed that sediment is still a slight impairment for the Edie Creek AU. Because the impairment is slight and the stream has an existing sediment TMDL, no new action is required. Further investigation is needed in Edie Creek to determine the extent of progress towards eliminating the sediment impairment in this system and ensuring the beneficial uses are fully supporting.

In the next Integrated Report, this AU should be listed in Category 4a for sediment and temperature. *E. coli* should be delisted from Category 5 for lack of impairment.

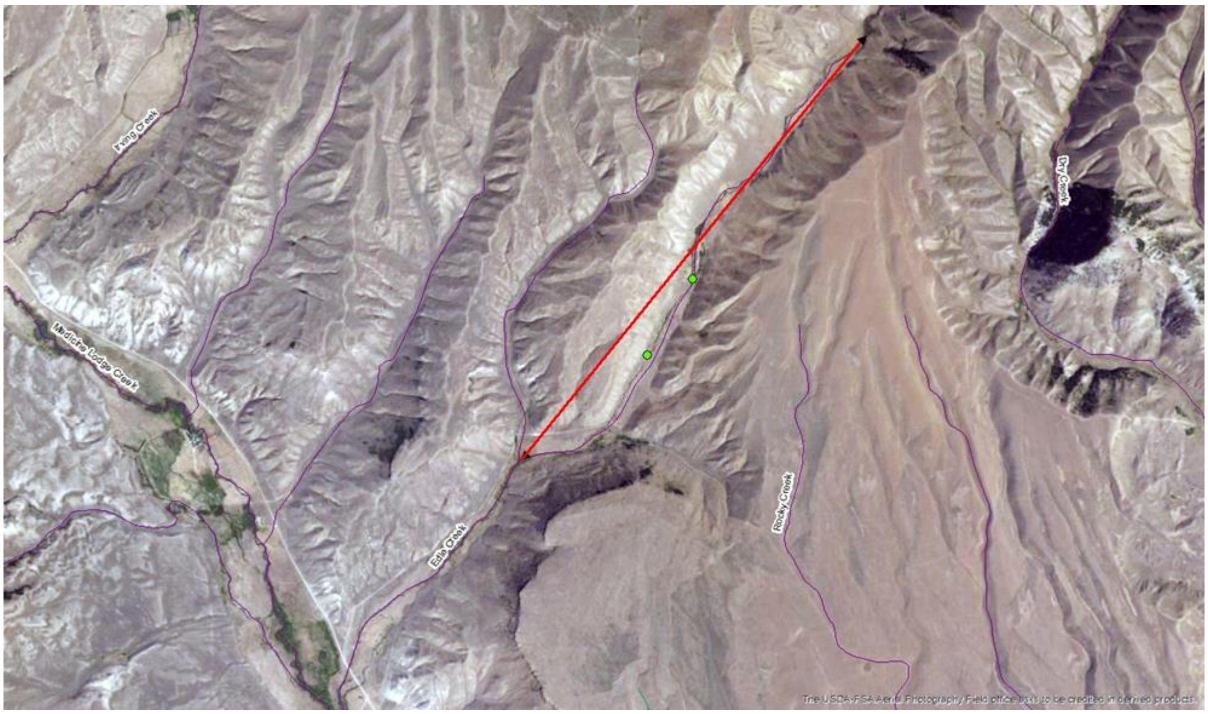


Figure 22. Map of the monitoring locations (between green dots) for Edie Creek (ID17040215SK010_02). Length of similar stream is shown with red line.

Photo 20

Figure 23. Sediment monitoring location for Edie Creek (ID17040215SK010_02).

Irving Creek (ID17040215SK012_02)

The headwaters AU of the Irving Creek watershed contain multiple 1st- and 2nd-order streams including The Bull Pen (East Fork Irving Creek), Deer Creek, Bear Canyon, Red Canyon, and upper Irving Creek.

Chronological Assessment History

- 1994 §303(d) list—Listed for sediment, habitat alteration, nutrients; referencing §305(b) Appendix D of 1992 water quality status report.
- 1994 and 1995 BURP sites—Not fully supporting for cold water aquatic life and salmonid spawning. Pebble counts showed surface fines <10% in 1994, but no sediment data were taken in 1995.
- 1996 §303(d) list—Listed for sediment, habitat alteration, nutrients; referencing §305(b) Appendix D of 1992 water quality status report.
- 1998 §303(d) list—Listed for habitat alteration, nutrients, and sediment.
- 1998 BURP site—Bacteria data showed not fully supporting secondary contact recreation. Very low macroinvertebrate and habitat scores were exhibited in Irving Creek and low fish scores were exhibited in The Bull Pen. Pebble count data averaged 20% surface fines on Irving Creek and 31% in The Bull Pen.
- 2002 Integrated Report—Listed in Category 4c for habitat alteration and Category 5 for sediment.

- 2003 BURP site—Further bacterial sampling showed not fully supporting secondary contact recreation on The Bull Pen. Pebble count data showed an average of 33% surface fines.
- 2003 TMDL—Found no nutrient impairment; found temperature and sediment impairment and provided TMDL load allocations for both. Bacteria TMDL was not developed at this time.
- 2008 Integrated Report—This AU should have been listed in Category 4a for temperature and sediment, but this AU was missed. Listed in Category 5 for fecal coliform. **Note**: This AU is listed in the 2008 Integrated Report under “Delisted Assessment Units” (page 159) as having approved sediment and temperature TMDLs, but it was mistakenly not included in Category 4a.
- 2010 Integrated Report—Correctly listed in Category 4a for sediment and temperature and in Category 5 for *E. coli.*
- 2011 and 2012 DEQ investigations—Showed this AU was not impaired for bacteria (section 2.3.1.3) and in the next Integrated Report should be listed in Category 4a for sediment and temperature. *E. coli* should be delisted from Category 5 because contact recreation is currently fully supported. A PNV temperature load allocation has been calculated to replace the earlier mass balance temperature approach.
- 2012 Integrated Report—Listed in Category 4a for sediment and temperature and in Category 5 for *E. coli.*

A map of the monitoring location for Irving Creek (ID17040215SK012_02) is shown in Figure 24. In the next section (ID17040215SK012_03), Figure 26 shows the 3rd-order segment of Irving Creek (ID17040215SK012_03) just below the confluence with The Bull Pen and the 2nd-order segment. Assessment efforts have been focused on an area in the middle of 2nd-order Irving Creek.

DEQ found evidence of eroding streambanks in upper Irving Creek. Although lateral recession rate scoring was not greater than expected, the amount of erosive bank is greater than the 20% threshold typical of natural bank stability estimates sufficient to create a sediment load that exceeded load capacity. As shown on the SEI calculations in Appendix D, out of 1,110 meters of streambank inventoried, 34.2% exhibited erosion, and this can be extrapolated to 4,559 meters of similar stream. This results in a total sediment load of 213.4 tons per year, which is greater than the assimilative load capacity of 124.9 tons per year. A McNeil core depth fine sediment sample was taken within this same reach. Mean depth fines (without 2.5-inch particles) were 41%, greater than the 28%–33% fines deemed acceptable under natural conditions. Sediment impairment above natural background is still present in this stream.

Upper Irving Creek (ID17040215SK012_02) currently has an approved sediment TMDL (DEQ 2003). Results of analyses for excess sediment showed that sediment is still an impairment for the upper Irving Creek AU. Because the stream has an existing sediment TMDL, no new action is required. Further investigation is needed in Irving Creek to determine the extent of progress towards eliminating the sediment impairment in this system and ensuring the beneficial uses are fully supporting.

Figure 24. Map of the monitoring locations (between green dots) for Irving Creek (ID17040215SK012_02). Length of similar stream is shown with red line.

Irving Creek (ID17040215SK012_03)

A map and photo of the monitoring location for Irving Creek (ID17040215SK012_03) are shown in Figure 25 and Figure 26 (photo 21). Assessment efforts have focused on an area of the 3rd-order segment of Irving Creek just below the confluence with The Bull Pen and the 2nd-order segment.

DEQ found no evidence of excessive eroding streambanks in this portion Irving Creek. Lateral recession rate scoring was not greater than expected, and the amount of erosive bank was not greater than expected based on 80% threshold typical of natural bank stability. As shown on the SEI calculations in Appendix D, out of 823 meters of streambank inventoried, 5.1% exhibited erosion, and this can be extrapolated to 1,200 meters of similar stream. This results in a total sediment load of 5.0 tons per year, which is less than the assimilative load capacity of 49.4 tons per year. A McNeil core depth fine sediment sample was taken within this same reach. Mean depth fines (without 2.5-inch particles) were 43%, greater than the 28%–33% fines deemed acceptable under natural conditions. Sediment impairment above natural background is still present in this stream, likely from streambank erosion in the 2nd-order unit as discussed in ID17040215SK012_02 above.

Lower Irving Creek (ID17040215SK012_03) currently has an approved sediment TMDL (DEQ 2003). Results of analyses for excess sediment showed that sediment impairment may be decreasing for the lower Irving Creek AU as banks become more stable. Because the stream has an existing sediment TMDL, no new action is required. Further investigation is needed in Irving Creek to determine the extent of progress towards eliminating the sediment impairment in this system and ensuring the beneficial uses are fully supporting. The AU also has an existing temperature TMDL that was revised using the PNV method.

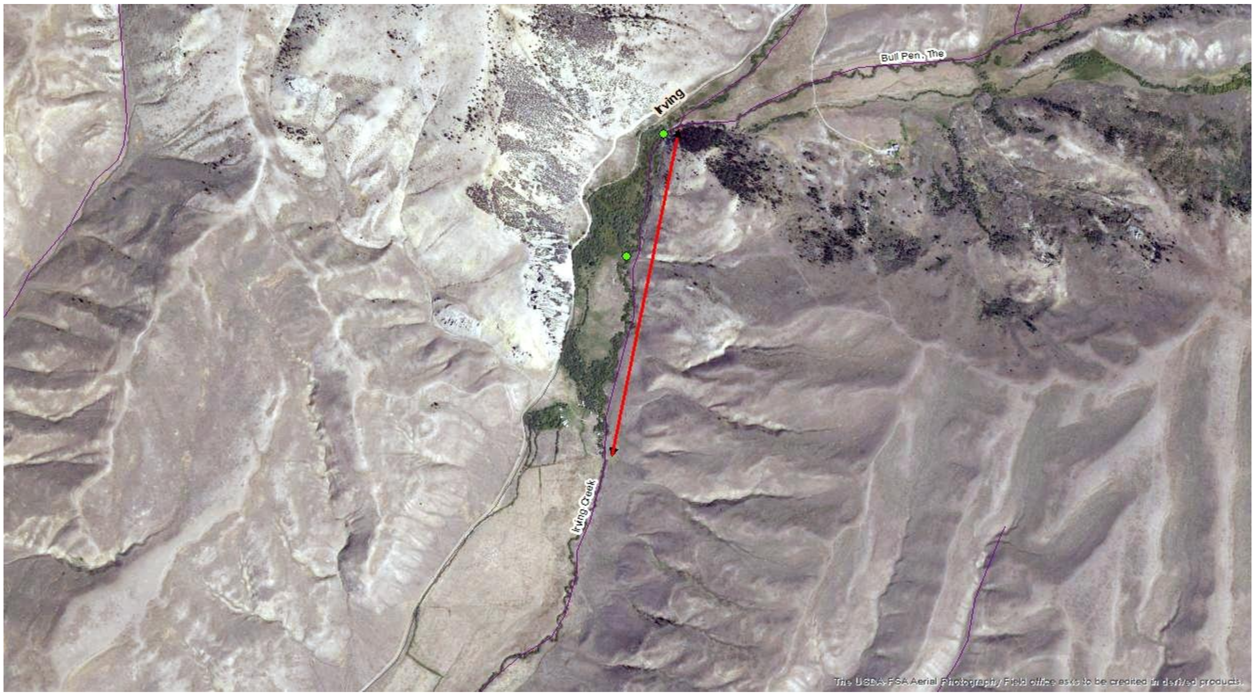


Figure 25. Map of the monitoring locations (between green dots) for Irving Creek (ID17040215SK012_03). Length of similar stream is shown with red line.

Photo 21

Figure 26. Sediment monitoring location for Irving Creek (ID17040215SK012_03).

Warm Creek (ID17040215SK013_02)

This AU includes several watersheds that are tributaries to Divide Creek in the northern most portion of the subbasin. The Warm Creek watershed itself includes Black Canyon, Limestone Gulch, and an unnamed tributary in addition to the 1st- and 2nd-order reaches of Warm Creek.

Chronological Assessment History

- 1994 §303(d) list—Listed for nutrients and thermal modification, referencing §305(b) Appendix D of 1992 water quality status report.
- 1995 BURP site—Located near the mouth of Warm Creek, this site had very low macroinvertebrate and habitat scores. Crews commented on a sulphur smell at the sampling location, which suggests a geothermal influence. No pebble count data are available.
- 1996 §303(d) list—Listed for nutrients and thermal modification, referencing §305(b) Appendix D of 1992 water quality status report. It is not known what data were available for these listings.
- 1998 §303(d) list—In chapter 2.5 page 21 of DEQ's 1998 305(b) report, Warm Creek was found to be fully supporting beneficial uses based on 1994 and 1995 BURP data.
- 2002 Integrated Report—Listed in Category 3 for not assessed, but it is not clear why. Presumably, the previous information was considered inadequate for listing purposes, and the AU reverted back to unassessed.
- 2003 TMDL—The basin-wide temperature study showed that this AU was impaired for temperature, and a temperature TMDL was developed.
- 2006 BURP site—This randomly selected location was to be high in the watershed on the upper reaches of Warm Creek; however, crews found the site inaccessible and did not sample.
- 2008 Integrated Report—Listed in Category 4a for approved temperature TMDL and Category 5 for sediment.
- 2010 Integrated Report—Listed in Category 4a for approved temperature TMDL and Category 5 for sediment.
- 2011 and 2012 DEQ investigations using SEI showed no streambank erosion. A PNV temperature TMDL was calculated to replace the earlier mass balance approach.
- 2012 Integrated Report—Listed in Category 4a for approved temperature TMDL and Category 5 for sediment.

A map and photo of the sediment monitoring location for Warm Creek (ID17040215SK013_02) are shown in Figure 27 and Figure 28. Warm Creek is a 2nd-order high-mountain stream that joins with the ephemeral 2nd-order Divide Creek channel to provide perennial discharge to the 3rd-order Divide Creek channel. Warm Creek comes from a rockier geology that harbors snowmelt longer into the season and provides streamflow to the Divide Creek drainage below this AU.

Warm Creek appears to be a small perennial stream in stable condition throughout its length. The unimproved path in photo 12 is the nearest thing to a potential sediment impact but does not appear to affect the channel. The 2011 DEQ investigation determined that there were no impairments to the streambanks locally. As shown on the SEI calculations in Appendix D, out of 700 meters of streambank inventoried, none were erosive streambanks. SEI results can be extrapolated to 2,672 meters of similar stream. Sediment impairment from streambanks is not present in this stream segment. Due to the size of the stream and the lack of access (no roads), it is likely that this AU is not impacted by sediment and is a candidate for delisting. The AU does have an existing temperature TMDL. The 1995 BURP site suggests that there may be a geothermal influence to the stream (i.e., “Warm Creek”), which may in turn affect the macroinvertebrate community. Habitat scores are likely low because it is small, grass-dominated riparian area.

Although a candidate for delisting sediment, more pebble count data need to be accumulated before proceeding with the delisting process. The geothermal possibility must be explored as well.

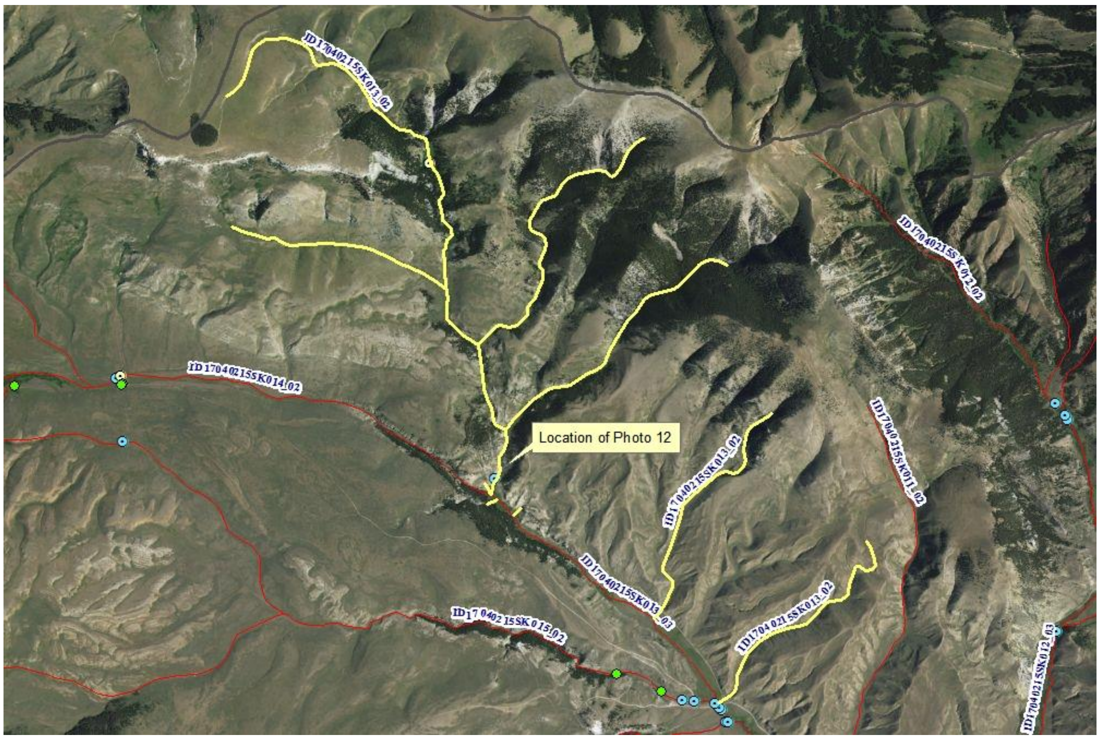


Figure 27. Map of monitoring location (photo 12) for Warm Creek (ID17040215SK013_02).

Photo 12

Figure 28. Sediment monitoring location for Warm Creek (ID17040215SK013_02).

Warm Creek—Divide Creek below confluence of Warm and Divide Creeks (ID17040215SK013_03)

This AU includes the 3rd-order segment of Warm Creek (i.e., Divide Creek below the confluence of Warm and Divide Creeks to the point where Divide Creek and Fritz Creek converge to form Medicine Lodge Creek). **Note**: According to the 2010 Integrated Report, bacteria sampling for Divide Creek was collected downstream in the Warm Creek AU (ID17040215SK013_03) where there was water.

Chronological Assessment History

- 1994 §303(d) list—Not listed.
- 1996 §303(d) list—Not listed.
- 1998 §303(d) list—Not listed.
- 1994 and 1995 BURP locations—Not fully supporting cold water aquatic life. The 1994 site showed an average pebble count result of 42% surface fines; no data are available for the 1995 site. The area appeared to be substantially grazed and lacked riparian cover. A 2001 BURP site on Horse Creek near its confluence with Divide Creek was also used to assess this AU; technically, Horse Creek is in the ID17040215SK015_02 AU.
- 2002 Integrated Report—Listed in Category 2 for supporting some uses, but it is entitled "Warm Creek."
- 2003 TMDL—Temperature was identified as a pollutant, and a temperature TMDL was written for this AU.

- 2008 Integrated Report—Listed in Category 4a for temperature and Category 5 for sediment.
- 2010 Integrated Report—Listed in Category 4a for temperature and Category 5 for sediment.
- 2011 and 2012 DEQ investigations—No sediment monitoring took place within this AU.

Temperature monitoring presented in 2003 TMDL showed temperature impairment, and a temperature TMDL was provided. This TMDL addendum and 5-year review provides a temperature TMDL based on PNV to replace the earlier mass balance method.

E. coli bacteria sampling indicated an exceedance with four samples in 2010 and five samples in 2011 (section 2.3.1.3). Even with a fifth value of 2 cfu/100 mL added to the 2010 data, there would be sufficiently high geometric mean to exceed standards. Therefore, an *E. coli* TMDL is provided in this document.

This AU should remain in Category 5 for sediment until further sediment work can be accomplished, and remain listed in Category 4a for temperature TMDL. *E. coli* can be added to Category 4a once the TMDL is approved.

<u>Divide Creek—source to Warm Creek (ID17040215SK014_02)</u>

This AU includes the upper 1st- and 2nd-order reaches of Divide Creek above Warm Creek, as well as several unnamed tributaries (Figure 29). **Note**: According to the 2010 Integrated Report, bacteria sampling for Divide Creek was collected downstream in the Warm Creek AU (ID17040215SK013_03) where there was water.

Chronological Assessment History

- 1994 §303(d) list—Not listed.
- 1996 §303(d) list—Not listed.
- 1998 §303(d) list—Not listed.
- 1997 BURP location—Not fully supporting cold water aquatic life and secondary contact recreation. This site was sampled in September 1997, and flow was very low (0.1 cfs). Pebble count data revealed an average of 7% surface fines. The site had poor macroinvertebrate scores, possibly due to lack of water.
- 2002 Integrated Report—Listed in Category 5 for pathogens likely due to sampling in the third order AU below it.
- 2003 (July 23) BURP location dry.
- 2003 TMDL—Found this AU of Divide Creek to be dry during the subbasin-wide temperature study and was not included in the temperature TMDL. The bacteria impairment was not yet assessed at the time of the writing of this TMDL.
- 2008 Integrated Report—Listed in Category 5 for fecal coliform. This 2nd-order AU was probably listed because of its proximity to the 3rd-order AU, which was sampled for bacteria. However, the majority of the 3rd-order water comes from perennial Warm Creek, not from this AU.
- 2010 Integrated Report—Listed in Category 5 for combined biota and *E. coli* (bacteria sampling was collected downstream in ID17040215SK013_03 where there was water).
- 2014 (July 1) BURP location dry.

BURP site, 1997SIDFM136, was used in the assessment that resulted in combined biota/habitat bioassessment impairment (September 10). The 2nd-order AU of Divide Creek is an ephemeral storm flow-response gully that only had 0.1 cfs flow during the 1997 visit assessed in Table 8 and has always been dry upon subsequent visits. The 2003 BURP site visit found this AU of Divide Creek to be dry in the same location. A recent 2014 BURP site visit (2014SIDFA001, July 1) lower in the AU also found the stream dry.

Table 8. BURP assessment leading to combined biota/habitat bioassessment impairment for Divide Creek (ID17040215SK014_02).

Burp ID	Stream	SMI Score	SMI Rating	SMI BioRegion	SFI Score	SFI Rating	SFI BioRegion	SHI Score	SHI Rating	SHI BioRegion	Average
1997SIDFM136	Divide Creek	35.73	1.00	Basins	—	—	—	56.00	2.00	So. Basins	1.50

Notes: Stream Macroinvertebrate Index (SMI); Stream Fish Index (SFI); Stream Habitat Index (SHI)

This AU was listed in Category 5 of the 2012 Integrated Report for combined biota/habitat bioassessments based on this 1997 BURP site and for *E. coli* impairment. Subsequent DEQ visits in 2003, 2011, 2012, and 2014 showed this channel to be dry. This AU has a limited flow season in response to spring runoff or storm flow. Evidence that this entire AU is a storm flow-response gully and ephemeral in nature includes the following:

- Water is not present frequently enough to form riparian vegetation except for one or two patches of sedges.
- This AU averages 7,100-foot elevation, gradient 0.04%, Rosgen channel type B drainage in silty soils that do not harbor snowmelt waters very long into the season, so when water is present, it drains quickly through the channel. Where Warm Creek drainage joins at the bottom of this AU, it comes from a rockier geology that harbors snowmelt longer into the season and provides streamflow to the Divide Creek drainage below this AU.
- Figure 29 shows this AU in the Level 4 ecological site classes “Barren Mountains” and “Dry Gneissic-Schistose-Volcanic Hills” indicating the locations of the geolocated photo documentation from the DEQ visit in September 2012.

In Figure 30, photos 1 and 2 were taken at the same location as the 1997 BURP visit, showing the dry channel where water is present too infrequently to form riparian vegetation. Figure 30, photo 3 is taken where maps show the 1st-order drainage, but there is no discernable channel.

There is no minimum streamflow requirement for narrative standards such as sediment. Wherever a channel was discernable, DEQ investigated it for impairment to streambanks to ensure that when water is present in the channel, the channel does not have the potential to transport an excess sediment load downstream outside of runoff events. The streambanks were found to be stable in the streambank stability investigations. As shown on the SEI calculations in Appendix D, out of 867 meters of streambank inventoried on Divide Creek, only 1.3% exhibited erosion, and this can be extrapolated to 8,607 meters of similar stream. This results in a total sediment load of 0.5 tons per year, which is less than the assimilative load capacity of 7.1 tons per year. Sediment impairment streambank erosion is not present in this stream segment.

The *E. coli* TMDL presented in this document is for the 3rd-order segment of Divide Creek immediately downstream, which is created when water from Warm Creek enters the channel.

There was no temperature TMDL produced for this AU. Evidence suggests that this AU should be delisted for combined biota/habitat bioassessments and *E. coli* based on a lack of water during the assessment time frame (July–September), a lack of bank disturbance, and visual inspection of the channel gravels (Figure 30, photos 1 and 2).

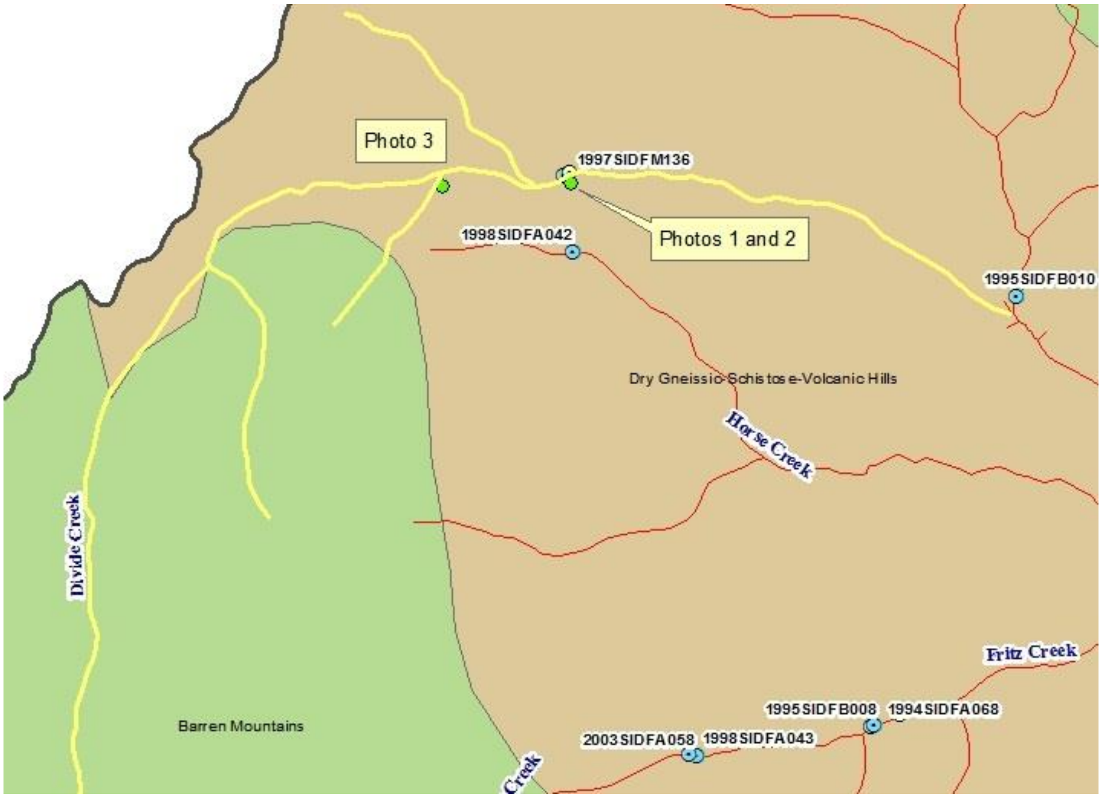


Figure 29. Map of monitoring locations (photos 1, 2, and 3) for Divide Creek (ID17040215SK014_02).

Photo 1

Photo 2

Photo 3

Figure 30. Monitoring locations for Divide Creek (ID17040215SK014_02).

Horse Creek—source to mouth (ID17040215SK015_02)

This AU includes Horse Creek and a unnamed tributary. Horse Creek drains to the 3rd-order of Divide Creek at a location just upstream of the confluence with Fritz Creek.

Chronological Assessment History

- 1994 §303(d) list—Not listed.
- 1996 §303(d) list—Not listed.
- 1998 §303(d) list—Not listed.
- 1997 and 1998 BURP locations—Not fully supporting cold water aquatic life. Both locations fully support recreation uses (low bacteria counts). The 1997 site, low in the watershed near the mouth of Horse Creek, had a very high surface fines of 69% based on average pebble count data. The 1998 site sampled high in the watershed near the headwaters had an average pebble count of 22% surface fines.
- 2002 Integrated Report—Listed in Category 5 for unknown and sediment.
- 2003 BURP location near the mouth of Horse Creek was almost dry and not sampled.
- 2003 TMDL—Temperature was identified as a pollutant, and a temperature TMDL was written for this AU.
- 2008 IR—Listed in Category 4a for approved temperature TMDL and Category 5 for combined biota/habitat bioassessment and sediment.
- 2010 IR—Listed in Category 4a for approved temperature TMDL and Category 5 for combined biota/habitat bioassessment and sediment.
- 2011 and 2012 DEQ investigations—Showed no bank erosion in the monitored reach.
- 2012 Integrated Report—Listed in Category 4a for approved temperature TMDL and Category 5 for combined biota/habitat bioassessment and sediment.

The 2003 TMDL identified temperature as an impairment and provided a temperature load allocation. When sediment was added to the 2002 Integrated Report, it was based on field audits by BLM and DEQ pebble count information. DEQ recently investigated this AU for sediment impairment and found no excessive erosion. A map and photo of the monitoring location for Horse Creek is shown in Figure 31 and Figure 32. Some potential sediment impacts include an adjacent road parallel to the lower portion of the 2nd-order reach and some cattle trails. Photo 13 shows one of two high banks measured throughout the SEI, which both appeared to be a feature of geological terracing rather than rangeland impacts. The remainder of the stream was vegetated and stable. As shown on the SEI calculations in Appendix D, out of 329 meters of streambank inventoried, only 7.2% exhibited erosion, and this can be extrapolated to 5,486 meters of similar stream. This results in a total sediment load of 5.6 tons per year, which is less than the assimilative load capacity of 15.5 tons per year. Sediment impairment via bank erosion is not present in this stream segment.

Despite the positive results from the streambank erosion survey, the stream lacks shade and has a temperature TMDL completed for it. It is likely that the stream is in recovery and improving both with regard to sediment and temperature, which will hopefully result in better assessments in the future. The AU will remain in Category 5 for combined biota/habitat bioassessments and sediment until further bioassessment and sediment (percent fines investigations) work can be done.

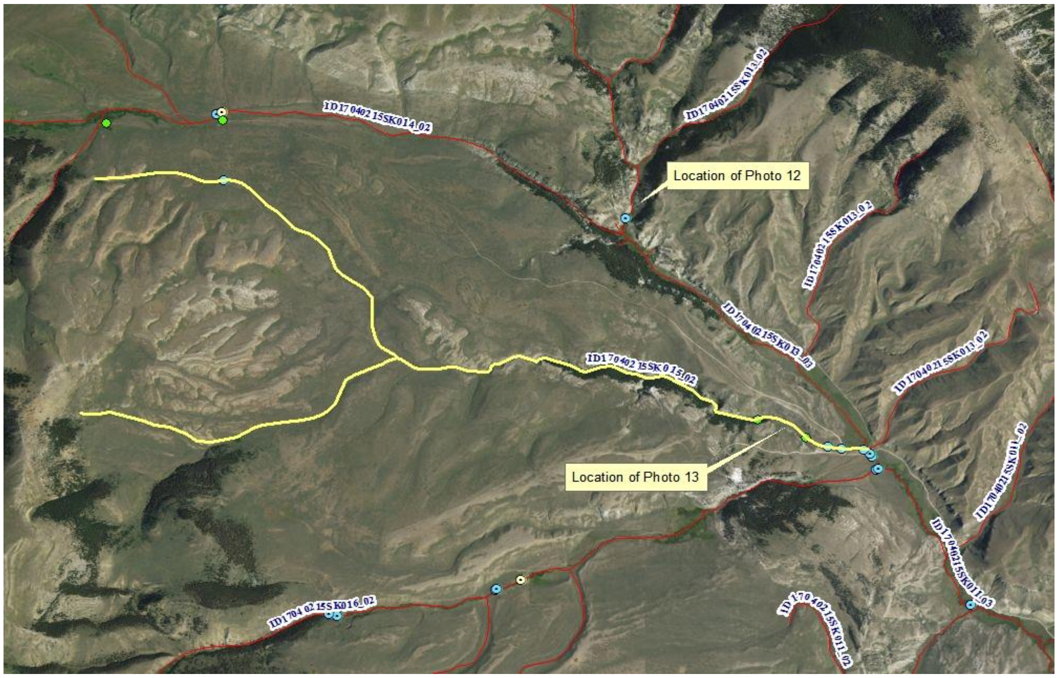


Figure 31. Map of the monitoring location (photo 13) for Horse Creek (ID17040215SK015_02).

Photo 13

Figure 32. Sediment monitoring location for Horse Creek (ID17040215SK015_02).

Deep Creek—source to mouth (ID17040215SK018_02)

Deep Creek is a large watershed parallel to Medicine Lodge Creek on its west side. Deep Creek drains southeast and is lost to the agricultural lands but does not interconnect with any other water bodies. The 2nd-order AU of Deep Creek includes the upper half of the Deep Creek watershed as well as a number of parallel drainages to the east between Deep Creek and Medicine Lodge Creek. Most of these drainages are ephemeral and lost to the desert or to adjacent agricultural lands.

Chronological Assessment History

- 1994 §303(d) list—Not listed.
- 1996 §303(d) list—Not listed.
- 1998 §303(d) list—Not listed.
- 1998, 2003 BURP location—Not fully supporting cold water aquatic life and fully supporting secondary contact recreation. This site showed high fines in the pebble count data (46%) in 2 cfs of water in 1998. Comments revealed that extensive heavy grazing was occurring in the area at that time. A subsequent visit to the same site location in 2003 showed flow levels too low (<1 cfs) to sample; however notes reveal that cattle were in the stream above the site and water was warm (28 °C) and brown.
- 2002 Integrated Report—Listed in Category 5 for unknown, a place holder for combined biota/habitat bioassessment.
- 2003 TMDL—Temperature was identified as a pollutant, and a temperature TMDL was written for this AU.
- 2007 and 2014 BURP locations—These sites were to be located on parallel drainages to the east of Deep Creek, unfortunately the 2007 location was not accessible due to private land and the 2014 location was dry.
- 2008 Integrated Report—Listed in Category 4a for approved temperature TMDL and Category 5 for combined biota/habitat bioassessment and sediment.
- 2010 Integrated Report—Listed in Category 4a for approved temperature TMDL and Category 5 for combined biota/habitat bioassessment and sediment.
- 2011 and 2012 DEQ investigations—Showed no sediment or nutrient impairments.
- 2012 Integrated Report—Listed in Category 4a for approved temperature TMDL and Category 5 for combined biota/habitat bioassessment and sediment.

The 2003 TMDL identified temperature as an impairment and provided a temperature load allocation. When sediment was added to the 2002 Integrated Report, it was based on field audits by BLM. The 1998 BURP site concurred with those results. A map and photos of the 2011 and 2012 monitoring locations for Deep Creek (ID17040215SK018_02) are shown in Figure 33 and Figure 34.

Second-order Deep Creek (ID17040215SK018_02) is in remote area upland to the canyon. The DEQ 2011 sediment monitoring location was located at the one unimproved ford in the AU, where previous BURP monitoring had occurred. Notes from the 1998 bioassessment indicated that a large herd of sheep and some cattle were in the area, actively impacting the streambanks at the location of the ford. The 2003 bioassessment also noted cattle in the same area. From the 2011 sediment monitoring, other than this ford, there are no observed sources or pathways of sediment impairment. There are no roads adjacent to the streambank, and it was vegetated and stable. DEQ was unable to find any eroding streambanks or other potential sources or pathways of sediment impairment in that area. An erosion inventory was not conducted. Deep Creek is in the Crooked Creek grazing allotment administered by the BLM Upper Snake Field Office. DEQ advises this office to focus future watershed improvements on the ford to keep it from being a congregating area. It would appear that conditions have substantially improved. The improvement needs to be verified with more bioassessments, and percent fines data should be collected in other parts of the AU in the future.

This AU should remain listed in Category 5 for combined biota/habitat bioassessments and sediment until further investigations, and remain in Category 4a for the temperature TMDL.

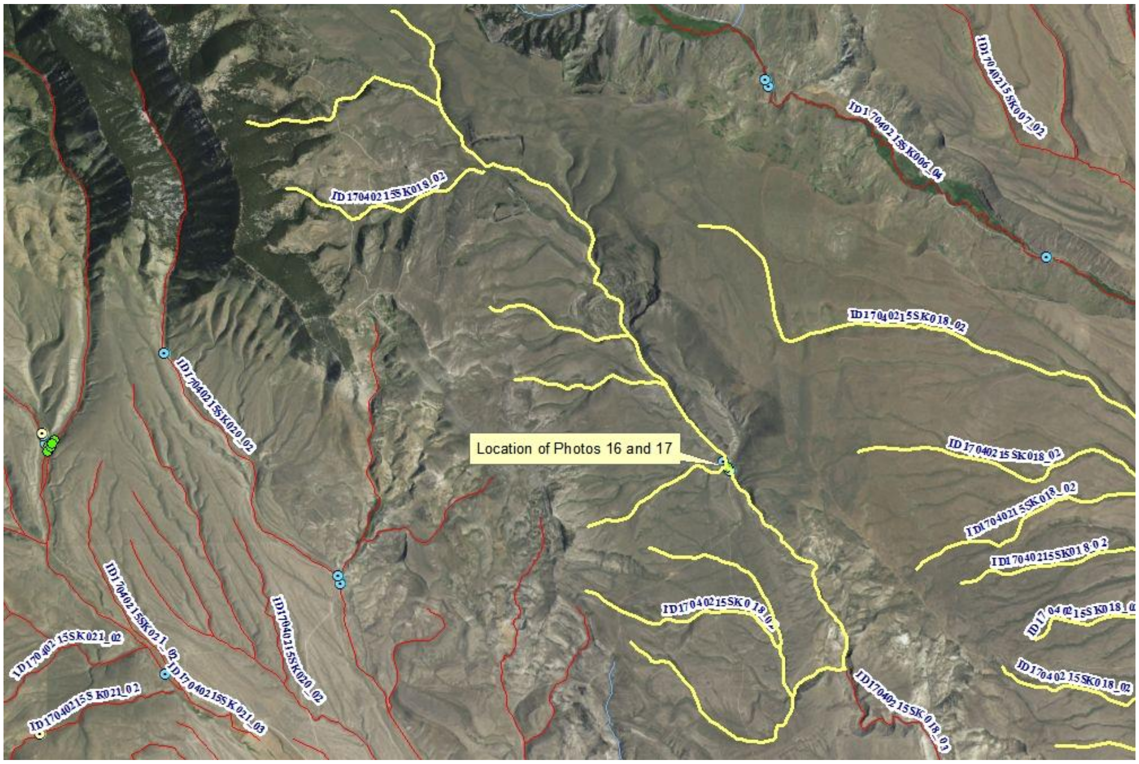


Figure 33. Map of the monitoring locations (photos 16 and 17) for Deep Creek (ID17040215SK018_02).

Photo 16

Photo 17

Figure 34. Sediment monitoring locations for Deep Creek (ID17040215SK018_02).

<u>Deep Creek—source to mouth (ID17040215SK018_03)</u>

This AU is the 3rd-order segment of Deep Creek and includes no other drainages or water bodies.

Chronological Assessment History

- 1994 §303(d) list—Not listed.
- 1996 §303(d) list—Not listed.
- 1998 §303(d) list—Not listed.
- 2002 Integrated Report—Listed in Category 3 for not assessed.
- 2003 TMDL—Temperature was identified as a pollutant, and a temperature TMDL was written for this AU.
- 2008 Integrated Report—Listed in Category 4a for approved temperature TMDL and Category 5 for sediment.
- 2010 Integrated Report—Listed in Category 4a for approved temperature TMDL and Category 5 for sediment.
- 2011 and 2012 DEQ investigations—Showed no sediment or nutrient impairments.

There are no BURP sites in this AU. The 2003 TMDL identified temperature as an impairment and provided a temperature load allocation. When sediment was added to the 2002 Integrated Report, it was based on field audits by BLM. A map and photos of the DEQ visual observation locations for Deep Creek (ID17040215SK018_03) are shown in Figure 35 and Figure 36. The lower portion of Deep Creek (ID17040215SK018_03) that is visible from nearby roads shows a dry channel with evidence of storm flow. There is a patch with cattails that may have ground water at certain times of the year. Storm flow is not present in the channel long enough to establish riparian vegetation. Upstream of this dry channel, 3rd-order Deep Creek is in an inaccessible canyon.

It is not clear at this time if this AU will be accessed and assessed further. DEQ doubts the stream has sufficient flow to support any aquatic life. This AU is a candidate for delisting from Category 5 for sediment. The AU will also remain in Category 4a for the temperature TMDL.

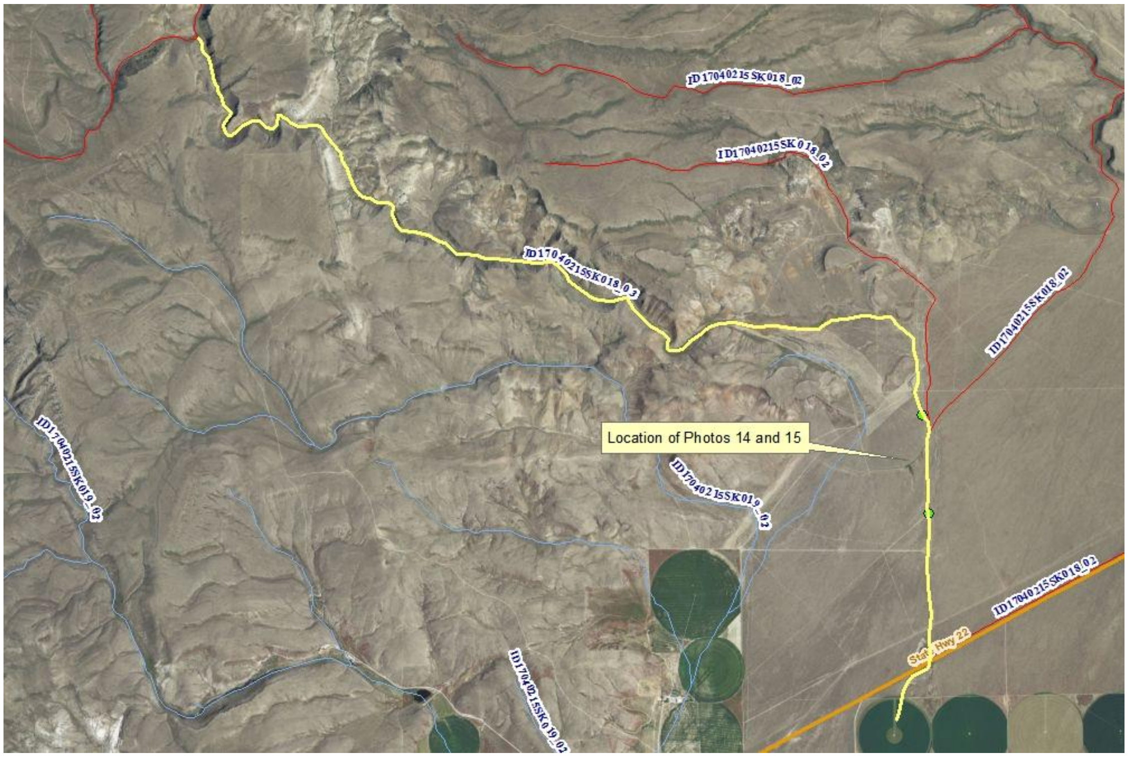


Figure 35. Map of the monitoring locations (photos 14 and 15) for Deep Creek (ID17040215SK018_03).

Photo 14 Photo 15

Figure 36. Sediment monitoring locations for Deep Creek (ID17040215SK018_03).

Crooked Creek—source to mouth (ID17040215SK021_02 & ID17040215SK021_03)

Crooked Creek is a large watershed to the west of Deep Creek and is the most western portion of the subbasin. Crooked Creek drains to the desert and agricultural lands to the southeast and does not interconnect with other water bodies. The drainage is extremely dry and contains a small amount of perennial flow in the Myers Creek confluence area.

Chronological Assessment History

- 1994 §303(d) list—Not listed.
- 1996 §303(d) list—Not listed.
- 1998 §303(d) list—Not listed.
- 1997 and 2003 BURP data—Not fully supporting for cold water aquatic life and secondary contact recreation. Pebble count data showed 25% (1997 and 2003) in Deep Creek and 17% (1997) and 25% (2003) in Myers Creek. The Deep Creek location was visited again in 2013 and found to have insufficient flow for sampling.
- 2002 Integrated Report—Listed in Category 5 for unknown.
- 2003 TMDL—Temperature was identified as a pollutant, and a temperature TMDL was written for this AU.
- 2008 Integrated Report—Listed in Category 4a for approved temperature TMDL and Category 5 combined biota/habitat bioassessment and sediment.
- 2010 Integrated—Listed in Category 4a for approved temperature TMDL and Category 5 for combined biota/habitat bioassessment, *E. coli*, and sediment.
- 2011 and 2012 DEQ investigations—Showed no obvious signs of sediment impairments.
- 2012 Integrated Report—Listed in Category 4a for approved temperature TMDL and Category 5 for combined biota/habitat bioassessment, *E. coli*, and sediment.

The 2003 TMDL identified temperature as an impairment and provided a temperature load allocation for both AUs. Bacteria data show no exceedance (section 2.3.1.3). When sediment was added to the 2002 Integrated Report, it was based on field audits by BLM. A map and photos of the DEQ 2011 and 2012 sediment monitoring locations for Crooked Creek (ID17040215SK021_02) are shown in Figure 37 and Figure 38. Assessment efforts have been focused on the area of the confluence of Myers Creek with Crooked Creek where there tends to be more water.

DEQ found no evidence of eroding streambanks in concentrated sediment investigations above and below an allotment fence in Myers Creek. Some areas of trampling were seen, but no bare banks existed downstream of the allotment fence, as shown in Figure 38, photo 18. Upstream of the allotment fence, some banks had slumping vegetation and vertical banks. Annual vegetation mixed with perennials occupied some previously eroded areas. Upon measuring the eroding areas and calculating the potential sediment load, they were found to be within the assimilative capacity of the stream.

As shown on the SEI calculations in Appendix D, out of 476 meters of streambank inventoried, 12.8% exhibited erosion, and this can be extrapolated to 1,372 meters of similar stream. This results in a total sediment load of 4.5 tons per year, which is less than the assimilative load capacity of 7.0 tons per year. Sediment impairment from bank erosion is not present in this stream segment.

It is not clear from the available data that sediment is a problem in Crooked Creek and Myers Creek at the confluence. However, this is a relatively small portion of the overall AU. Water disappears rapidly below Myers Creek and Crooked Creek becomes perennially dry. The watersheds above the current sampling point need to be investigated more thoroughly before conclusions can be drawn. However, it does appear that this AU may be a candidate for delisting for sediment and bacteria in the future. This AU should remain listed in Category 5 for combined biota/habitat bioassessments and sediment, delisted for *E. coli* and remain in Category 4a for the temperature TMDL.

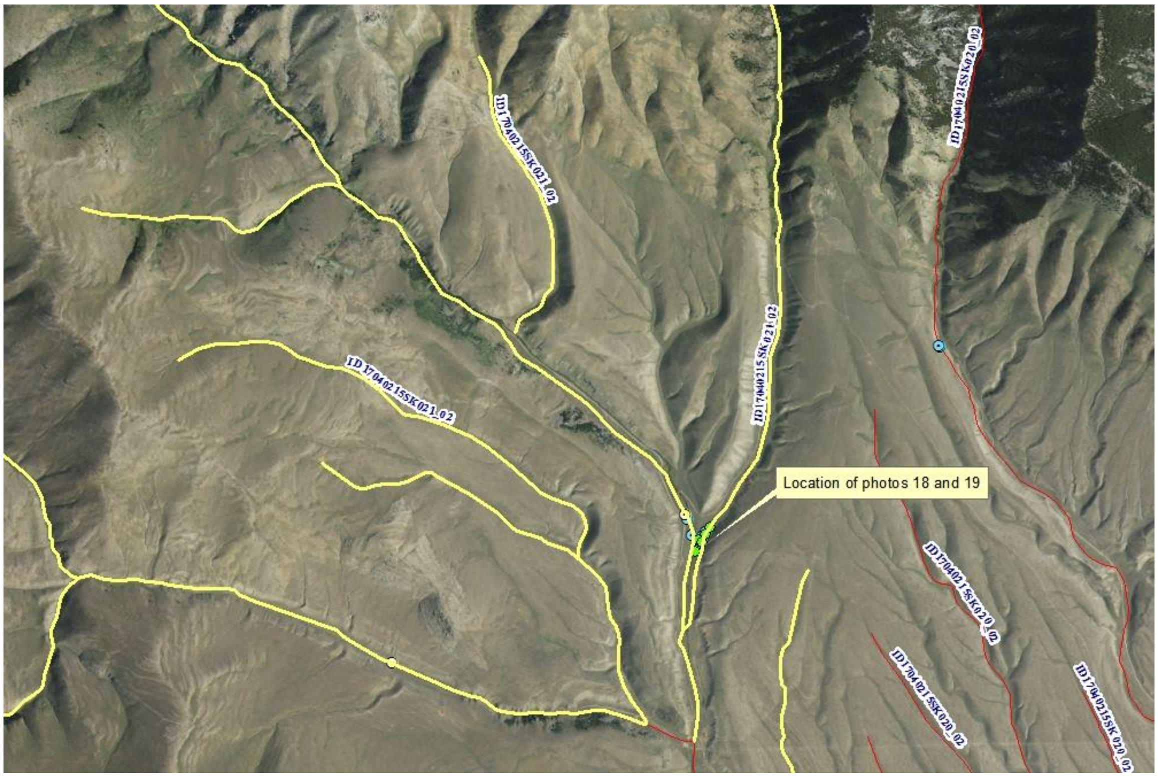


Figure 37. Map of the monitoring locations (photos 18 and 19) for Crooked Creek (ID17040215SK021_02).

Photo 18

Photo 19

Figure 38. Sediment monitoring location for Crooked Creek (ID17040215SK021_02).

3 Subbasin Assessment—Pollutant Source Inventory

Pollution within the Medicine Lodge Creek subbasin is from sediment, elevated instream temperature, and bacterial contamination. Load allocations were established in the *Medicine Lodge Subbasin Assessment and TMDLs* (DEQ 2003) for sediment and temperature. Bacteria load allocations are provided in this document.

3.1 Point Sources

Point sources are pollutants from known discharge locations. There are no known National Pollutant Discharge Elimination System (NPDES)-permitted point source discharges in this subbasin. Thus, there are no wasteload allocations.

An NPDES permit (IDU000121) had been issued to Medicine Lodge Ranch for general farms, primarily livestock and animal specialties. A buffalo ranch planned for this location did not develop, so this is not an active point source. It remains an unpermitted facility with no activity.

3.2 Nonpoint Sources

All pollutants are from nonpoint sources in this subbasin. Pollutants identified include sediment, temperature, and bacteria. Potential sources of these pollutants could include streambank modification and erosion, road construction, and rangeland management. Potential nutrient sources can include rangeland, pastureland, and cropland, but there are no identified nuisance levels of algal growth in Medicine Lodge Creek. Recreational activities may exhibit nonpoint sources of pollution where streambanks are becoming degraded by high use. Livestock grazing in riparian areas and erosion from roads and cultivated fields can be sources of excess sediment delivery to the streams. Destabilized streambanks can also contribute to reducing riparian vegetation that would provide shade, which leads to excess solar load and increased instream water temperatures.

3.3 Pollutant Transport

Pollutant transport refers to the pathway by which pollutants move from the pollutant source to cause a problem or water quality violation in the receiving water body. Where sediment is the stressor to water quality, there are complex interrelationships between the flow of water, movement of sediment, and mobile boundaries of the stream (Leopold et al. 1995). The physics of fluid force and fluid stresses; mass density of individual sediment grains and solid stresses; frictional forces; inclination angle of the streambed; and transport power as a function of force, distance, and time describe the potential for any given sediment particle to be transported. Leopold et al. (1995) provides a ratio showing that

$$\frac{\text{available bedload power}}{\text{available suspended-load power}}$$

becomes smaller, the bigger the river. Additional research (Wohl 2000) shows that bedload composes a much higher proportion of the total sediment load than suspended sediment in high-gradient streams. Bedload is also more important in forming and changing the channel of a mountain stream. Wohl (2000) goes on to show that bedload transport varies due to differential erosion and deposition associated with bedform sequences and the frequency of bedload movement is a function of hydrologic driving forces and channel resisting forces.

The basaltic and granitic parent geology in the Medicine Lodge Creek subbasin breaks down into heavier particles that tend to contribute to bedload rather than suspended sediment. In these higher-gradient mountain streams, baseflow does not have the power to transport these particles. As shown in Wohl (2000) for high-relief streams in dry climates, similar to the 1st-, 2nd-, and 3rd-order streams that are listed in Medicine Lodge Creek subbasin, only high-magnitude, low-frequency flows have the force to transport bedload sediment.

4 Subbasin Assessment—Summary of Past and Present Pollution Control Efforts

This 5-year TMDL review complies with Idaho Code §39-3611(7) to reevaluate the *Medicine Lodge Subbasin Assessment and TMDLs* (DEQ 2003). This review describes current water quality status and recent pollution control efforts in the subbasin. The assessment of instream targets, pollutant allocations, and analysis of the original TMDL are conducted with input and support from the watershed advisory group and basin advisory group.

4.1 Water Quality Monitoring and Improvements

Many watershed improvement projects with diverse funding sources have been completed or are ongoing in the Medicine Lodge Creek subbasin. Land management agencies have worked cooperatively together and with private landowners to implement BMPs that restore proper riparian function. All of the natural resource management agencies in the Medicine Lodge Creek subbasin are committed to restoring beneficial uses to critical areas and listed stream segments.

The Clark SCD has been active in implementing natural resource projects, and water quality and water resources remain the top resource concerns. The 2002 TMDL implementation plan for agriculture was developed into a project funded by a Clean Water Act §319 grant, subgrant number S051, in Medicine Lodge, Edie, Irving, and Fritz Creeks.

Project goals and accomplishments included the following:

- Restore beneficial uses on 35 miles of stream.
- Improve riparian and stream channel habitat.
- Reduce streambank and stream channel erosion.
- Improve grazing management with planned grazing, pasture, and exclusion fencing.
- Reduce livestock concentration on streams with off-stream water developments.
- Buffer streams with grass, shrubs, and trees.
- Stabilize eroding streambanks and channels using stream renaturalization techniques.
- Monitor progress and apply adaptive management.

Additional funding from the Agricultural Water Quality Cost-Share Program and Continuous Sign Up Conservation Reserve Program helped five landowners install approximately 485 acres of riparian forest buffer with livestock exclusions.

More recent projects administered by the Clark SCD include the following:

- The 2012–2013 planning, design, and installation of a stock water system in Middle Creek funded by the NRCS Environmental Quality Incentives Program and personal funding. Spring development from the headwaters of Middle Creek is fed into 13 miles of pipeline to bring stock water along the ridgeline to the west of the creek to eight troughs and four storage tanks. This project meets the NRCS objective to benefit the range resource as well as water quality objectives to protect water quality. In the previous condition, 600 head of cattle traversed 5 miles of steep country down to water and then back up to forage. After the project's first year, less sickness and death loss occurred in the cattle, and calves put on more weight. Immediate improvement was seen in Middle

Creek with regrowth of willows from existing root wads in the streambanks, along with better forage development of 11,000 acres of rangeland, benefitting both domestic livestock and wildlife.

- For better grazing utilization on rangeland, 1,309 meters of wildlife friendly fence were installed to split large pastures.
- Greatly improved soil health and reduced erosion occurred after 1,839 acres of prescribed grazing was implemented. New plant life and the retention of existing plant life are also benefits of prescribed grazing.
- A total of 20 watering facilities were installed to provide off-site water to livestock to reduce impacts to streambanks.

The BLM Upper Snake Field Office provided an implementation plan to document past land management improvement actions and planned strategies for meeting TMDL load allocations (BLM 2006). Watershed improvement projects and long-term monitoring occur in the following:

- Edie Creek—BLM manages 52% of the total stream length, where two protective fences and two stream exclosures were installed. After a fire in August 2003, BLM rebuilt the fences, installed streambank stabilization structures, and planted willows. Continued monitoring has shown high survival rates from the new willows and resprouting of water birches.
- Irving Creek—BLM manages 38% of Irving Creek and its tributaries. A flood in the early 1980s changed the morphology of West Fork Irving Creek, creating downcuts and establishing a lower floodplain. As a result, BLM only allows grazing here every 3 years to allow the channel to stabilize and reach a lower, wider floodplain. BLM continues to monitor streambank stability on Irving Creek and its tributaries as the historic flood left carved high, erodible streambanks that will continue to be a source of sediment until equilibrium is reached.
- Medicine Lodge Creek—BLM manages 14% of the total reach, but progress toward streambank stabilization is limited by county road encroachment causing mass wasting. BLM monitors streambank stability at a camp site in this watershed.
- Temperature-listed streams including Deep, Horse, Indian, Middle, and Warm Creeks—BLM monitors canopy cover along with streambank stability.

The Caribou-Targhee National Forest, Dubois Ranger District, manages riparian grazing on forest land in the drainage (Leffert 2005) according to these guidelines:

- Canopy cover of 80% or more
- Well-vegetated streambanks with minimal livestock trampling
- Overhanging vegetation available on 50% or more of the streambank to provide fish cover

Grazing allotments on forest land include requirements to install and maintain range improvement measures such as exclusion fencing and off-site watering.

5 Total Maximum Daily Load(s)

A TMDL prescribes an upper limit (i.e., load capacity) on discharge of a pollutant from all sources to ensure water quality standards are met. It further allocates this load capacity among the various sources of the pollutant. Pollutant sources fall into two broad classes: point sources, each of which receives a wasteload allocation, and nonpoint sources, each of which receives a load allocation. Natural background contributions, when present, are considered part of the load allocation but are often treated separately because they represent a part of the load not subject to control. Because of uncertainties about quantifying loads and the relation of specific loads to attaining water quality standards, the rules regarding TMDLs (40 CFR 130) require a margin of safety be included in the TMDL. Practically, the margin of safety and natural background are both reductions in the load capacity available for allocation to pollutant sources.

Load capacity can be summarized by the following equation:

$$LC = MOS + NB + LA + WLA = TMDL$$

where:

LC = load capacity
MOS = margin of safety
NB = natural background
LA = load allocation
WLA = wasteload allocation

The equation is written in this order because it represents the logical order in which a load analysis is conducted. First, the load capacity is determined. Then the load capacity is broken down into its components. If relevant, after the necessary margin of safety and natural background are quantified, the remainder is allocated among pollutant sources (i.e., the load allocation and wasteload allocation). When the breakdown and allocation are complete, the result is a TMDL, which must equal the load capacity.

The load capacity must be based on critical conditions—the conditions when water quality standards are most likely to be violated. If protective under critical conditions, a TMDL will be more than protective under other conditions. Because both load capacity and pollutant source loads vary, and not necessarily in concert, determining critical conditions can be more complicated than it may initially appear.

Another step in a load analysis is quantifying current pollutant loads by source. This step allows for the specification of load reductions as percentages from current conditions, considers equities in load reduction responsibility, and is necessary for pollutant trading to occur. A load is fundamentally a quantity of pollutant discharged over some period of time and is the product of concentration and flow. Due to the diverse nature of various pollutants, and the difficulty of strictly dealing with loads, the federal rules allow for “other appropriate measures” to be used when necessary (40 CFR 130.2). These other measures must still be quantifiable and relate to water quality standards, but they allow flexibility to deal with pollutant load in more practical and tangible ways. The rules also recognize the particular difficulty of quantifying nonpoint loads and allow “gross allotment” as a load allocation where available data or appropriate predictive techniques limit more accurate estimates. For certain pollutants whose effects are long term, such as sediment and nutrients, EPA allows for seasonal or annual loads.

Section 5.1 provides temperature load allocations, and section 5.2 provides bacteria load allocations for the Medicine Lodge Creek subbasin. All of the pollutant loads are allocated to nonpoint sources. There are no NPDES-permitted point sources in the affected watersheds and thus no wasteload allocations. Should a point source be proposed that would have thermal consequences on these waters, background provisions in Idaho water quality standards addressing such discharges (IDAPA 58.01.02.200.09; IDAPA 58.01.02.401.01) should be involved.

5.1 Temperature TMDLs

5.1.1 Instream Water Quality Targets

For the 22 AUs in the present temperature TMDLs, DEQ used a PNV approach. The Idaho water quality standards include a provision (IDAPA 58.01.02.200.09) that if natural conditions exceed numeric water quality criteria, exceedance of the criteria is not considered a violation of water quality standards. In these situations, natural conditions essentially become the water quality standard, and for temperature TMDLs, the natural level of shade and channel width become the TMDL target. The instream temperature that results from attaining these conditions is consistent with the water quality standards, even if it exceeds numeric temperature criteria. Appendix B provides further discussion of water quality standards and natural background provisions.

The PNV approach is described briefly below. The procedures and methodologies to develop PNV target shade levels and to estimate existing shade levels are described in detail in *The Potential Natural Vegetation (PNV) Temperature Total Maximum Daily Load (TMDL) Procedures Manual* (Shumar and de Varona 2009). The manual also provides a more complete discussion of shade and its effects on stream water temperature.

Factors Controlling Water Temperature in Streams

Several important factors contribute heat to a stream, including ground water temperature, air temperature, and direct solar radiation (Poole and Berman 2001). Of these, direct solar radiation is the source of heat that is most controllable. The parameters that affect the amount of solar radiation hitting a stream throughout its length are shade and stream morphology. Shade is provided by the surrounding vegetation and other physical features such as hillsides, canyon walls, terraces, and high banks. Stream morphology (i.e., structure) affects riparian vegetation density and water storage in the alluvial aquifer. Riparian vegetation and channel morphology are the factors influencing shade that are most likely to have been influenced by anthropogenic activities and can be most readily corrected and addressed by a TMDL.

Riparian vegetation provides a substantial amount of shade on a stream by virtue of its proximity. However, depending on how much vertical elevation surrounds the stream, vegetation further away from the riparian corridor can also provide shade. The shade that a stream receives can be measured in a number of ways. Effective shade (i.e., that shade provided by all objects that intercept the sun as it makes its way across the sky) can be measured in a given location with a Solar Pathfinder or with other optical equipment similar to a fish-eye lens on a camera.

Effective shade can also be modeled using detailed information about riparian plants and their communities, topography, and stream aspect.

In addition to shade, canopy cover is a similar parameter that affects solar radiation. Canopy cover is the vegetation that hangs directly over the stream and can be measured using a densiometer or estimated visually either on site or using aerial photography. All of these methods provide information about how much of the stream is covered and how much is exposed to direct solar radiation.

Potential Natural Vegetation for Temperature TMDLs

PNV along a stream is that riparian plant community that could grow to an overall mature state, although some level of natural disturbance is usually included in the development and use of shade targets. Vegetation can be removed by disturbance either naturally (e.g., wildfire, disease/old age, wind damage, and wildlife grazing) or anthropogenically (e.g., domestic livestock grazing, vegetation removal, and erosion). The idea behind PNV as targets for temperature TMDLs is that PNV provides a natural level of solar load to the stream without any anthropogenic removal of shade-producing vegetation. Vegetation levels less than PNV (with the exception of natural levels of disturbance and age distribution) result in the stream heating up from anthropogenically created additional solar inputs.

DEQ estimates PNV (and therefore target shade) from models of plant community structure (shade curves for specific riparian plant communities), and measures or estimates existing canopy cover or shade. Comparing the two (target and existing shade) tells how much excess solar load the stream is receiving and what potential exists to decrease solar gain. Streams disturbed by wildfire, flood, or some other natural disturbance will be at less than PNV and require time to recover. Streams that have been disturbed by human activity may require additional restoration above and beyond natural recovery.

Existing and PNV shade was converted to solar loads from data collected on flat-plate collectors at the nearest National Renewable Energy Laboratory (NREL) weather stations collecting these data. In this case, DEQ used the average loads from the Helena, Montana, and Pocatello, Idaho, stations. The difference between existing and target solar loads, assuming existing load is higher, is the load reduction necessary to bring the stream back into compliance with water quality standards (Appendix B).

PNV shade and the associated solar loads are assumed to be the natural condition; thus, stream temperatures under PNV conditions are assumed to be natural (so long as no point sources or other anthropogenic sources of heat exist in the watershed) and are considered to be consistent with the Idaho water quality standards, even if they exceed numeric criteria by more than 0.3 °C.

Existing Shade Estimates

Existing shade was estimated for 22 AUs from visual interpretation of aerial photos. Estimates of existing shade based on plant type and density were marked out as stream segments on a 1:100,000 or 1:250,000 hydrography taking into account natural breaks in vegetation density. Stream segment length for each estimate of existing shade varies depending on the land use or landscape that has affected that shade level. Each segment was assigned a single value representing the bottom of a 10% shade class (adapted from the cumulative watershed effects process, IDL 2000). For example, if shade for a particular stream segment was estimated somewhere between 50% and 59%, DEQ assigned a 50% shade class to that segment. The estimate is based on a general intuitive observation about the kind of vegetation present, its density, and stream width. Streams where the banks and water are clearly visible are usually in low shade classes (10%, 20%, or 30%). Streams with dense forest or heavy brush where no portion of the stream is visible are usually in high shade classes (70%, 80%, or 90%). More open canopies where portions of the stream may be visible usually fall into moderate shade classes (40%, 50%, or 60%).

Visual estimates made from aerial photos are strongly influenced by canopy cover and do not always take into account topography or any shading that may occur from physical features other than vegetation. It is not always possible to visualize or anticipate shade characteristics resulting from topography and landform. However, research has shown that shade and canopy cover measurements are remarkably similar (OWEB 2001), reinforcing the idea that riparian vegetation and objects proximal to the stream provide the most shade.

Solar Pathfinder Field Verification

The accuracy of the aerial photo interpretations was field verified with a Solar Pathfinder at 15 sites in 2014. The Solar Pathfinder is a device that allows one to trace the outline of shade-producing objects on monthly solar path charts. The percentage of the sun's path covered by these objects is the effective shade on the stream at the location where the tracing is made. To adequately characterize the effective shade on a stream segment, ten traces are taken at systematic or random intervals along the length of the stream in question.

At each sampling location, the Solar Pathfinder was placed in the middle of the stream at about the bankfull water level. Ten traces were taken following the manufacturer's instructions (i.e., orient to south and level). Systematic sampling was used because it is easiest to accomplish without biasing the sampling location. For each sampled segment, the sampler started at a unique location, such as 50 to 100 meters (m) from a bridge or fence line, and proceeded upstream or downstream taking additional traces at fixed intervals (e.g., every 50 m, 50 paces, etc.). Alternatively, one can randomly locate points of measurement by generating random numbers to be used as interval distances.

When possible, the sampler also measured bankfull widths, took notes, and photographed the landscape of the stream at several unique locations while taking traces. Special attention was given to changes in riparian plant communities and what kinds of plant species (the large, dominant, shade-producing ones) were present. One can also take densiometer readings at the same location as Solar Pathfinder traces. These readings provide the potential to develop relationships between canopy cover and effective shade for a given stream.

The results of the Solar Pathfinder field verification (Table 9) showed that the original aerial interpretation of existing shade was accurate at six of the 15 sites, was within 20% at eight sites, and exceeded 20% at only one site. These data were used to correct the interpretation at the site locations and to "calibrate the eyes" for a new interpretation on stream locations that were not field verified.

Table 9. Results of Solar Pathfinder field verification for fifteen sites.

aerial class	pathfinder actual	pathfinder class	delta		site name
30	14.7	10	20		Crooked 1
30	55.9	50	-20		Crooked 2
10	33.6	30	-20		Edie 1
30	35.7	30	0		Edie 2
40	43.7	40	0		EF Irving 1(Bull Pen)
40	42.3	40	0		Horse 1
20	33.8	30	-10		Irving 1
0	2	0	0		Medicine Lodge 1
20	19.4	10	10		Medicine Lodge 2
0	9.9	0	0		Medicine Lodge 3
10	62.4	60	-50		Middle 1
30	15.3	10	20		Myers 1
40	22	20	20		NF Fritz 1
60	61.7	60	0		NF Fritz 2
50	70.6	70	-20		Webber 1
			-3	average	
			18.77	std dev	
			9.50	95%CI	

Target Shade Determination

PNV targets were determined from an analysis of probable vegetation at the streams and comparing that to shade curves developed for similar vegetation communities in Idaho (Shumar and de Varona 2009). A shade curve shows the relationship between effective shade and stream width. As a stream gets wider, shade decreases as vegetation has less ability to shade the center of wide streams. As the vegetation gets taller, the more shade the plant community is able to provide at any given channel width.

Natural Bankfull Widths

Stream width must be known to calculate target shade since the width of a stream affects the amount of shade the stream receives. Bankfull width is used because it best approximates the width between the points on either side of the stream where riparian vegetation starts. Measures of current bankfull width may not reflect widths present under PNV (i.e., natural widths). As impacts to streams and riparian areas occur, width-to-depth ratios tend to increase such that streams become wider and shallower. Shade produced by vegetation covers a lower percentage of the water surface in wider streams, and widened streams can also have less vegetative cover if shoreline vegetation has eroded away.

Since, existing bankfull width may not be discernible from aerial photo interpretation and may not reflect natural bankfull widths, this parameter must be estimated from available information. DEQ used regional curves for the major basins in Idaho—developed from data compiled by Diane Hopster of the Idaho Department of Lands—to estimate natural bankfull width (Figure 39).

For each stream evaluated in the load analysis, natural bankfull width was estimated based on the drainage area of the Upper Snake Basin curve from Figure 39. Although estimates from other curves were examined (i.e., Salmon, Payette/Weiser), the Upper Snake Basin curve was ultimately chosen because of its proximity to the Medicine Lodge Creek watershed and similarities in geology and climate.

Tables containing natural bankfull width estimates for each stream in this analysis are presented in Appendix E. The load analysis tables contain a natural bankfull width and an existing bankfull width for every stream segment in the analysis based on the bankfull width results presented in Appendix E. Existing widths and natural widths are the same in load tables when there are no data to support making them differ.

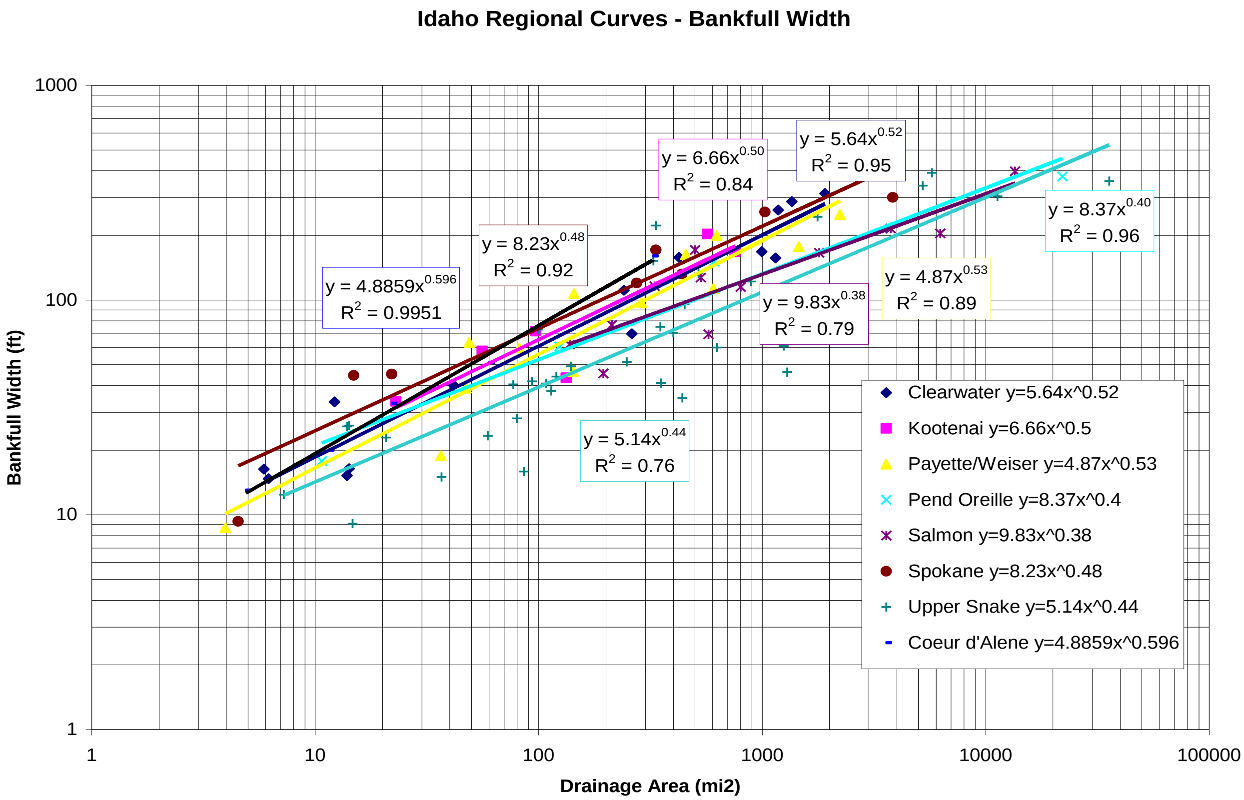


Figure 39. Bankfull width as a function of drainage area.

5.1.1.1 Design Conditions

The Medicine Lodge Creek subbasin drainage is on the eastern edge of the Lost Valleys basin and range type geomorphology. The subbasin has characteristics similar to the Lost River and Lemhi Mountain Ranges to the west. The Medicine Lodge Creek subbasin is located in the Middle Rockies Level 3 Ecoregion (McGrath et al. 2001) and is primarily in the Dry Gneissic-Schistose-Volcanic Hills Level 4 Ecoregion. This is an area underlain by Quaternary and Tertiary volcanics and dominated by sagebrush grasslands. It is less rugged and drier than the surrounding Barren Mountains. The headwaters regions of some tributaries extend into the Barren Mountains Level 4 Ecoregion, an area underlain by quartzite and carbonate-rich rocks from 6,800 to 10,000 feet in elevation. The Barren Mountains have open canopied Douglas firlodgepole pine-subalpine fir forests, aspen groves, sagebrush, mountain brush, and grasses. The forests are often limited to a narrow elevation band and are more common on north-facing slopes.

Shade Curve Selection

To determine PNV shade targets for the Medicine Lodge Creek subbasin, effective shade curves from the Targhee National Forest group and the southern Idaho nonforest group were examined, as shown in Table 10 (Shumar and de Varona 2009). These curves were produced using vegetation community modeling of Idaho plant communities. Effective shade curves include percent shade on the vertical axis and stream width on the horizontal axis. For the Medicine Lodge Creek subbasin, curves for the most similar vegetation type were selected for shade target determinations. Shade curves for forest patches on headwater streams were selected from Targhee National Forest Ecological Unit Inventory (Bowerman et al. 1999) as drawn on their maps. In some cases, no shade curves were developed for the specific ecological unit described, and an attempt was made to match the unit with a similar vegetation type in our inventory of shade curves in Shumar and de Varona (2009). Table 10 shows the matched shade curve in parentheses next to the corresponding unit. Ecological units encountered along streams examined include several forest types, a willow type, and several sagebrush/grass types. Most shrub-dominated riparian areas outside of the national forest were placed in the Geyer willow/sedge vegetation type of the Southern Idaho Nonforest Group as a typical midelevation willow type. Higher elevation areas were identified as alder or grasslands vegetation types. Many of the lower elevation drainages were identified as sagebrush/graminoid as there were no well-developed riparian plant communities. It is highly likely that these drainages are ephemeral or intermittent. The shade investigation only identified ephemeral drainages that were clearly dry channels with no vegetation as seen on the aerial photograph.

Table 10. Shade curves from Shumar and de Varona (2009) used as targets for streams.

Targhee Nonforest Ecological Unit Group	Southern Idaho Nonforest Group
1128 – threetip sage/Idaho fescue	Geyer willow/sedge
1129 – limber pine/Douglas fir	alder
1133 (1760) – Douglas fir/sage	sagebrush/graminoid
1147 – threetip sage/Idaho fescue	graminoid (grass)
1149 – Douglas fir/Carex	black cottonwood
1154 – Douglas fir/graminoid	—
2606 – willow/graminoid	—
1303 (1315) – subalpine fir/Douglas fir	—

Note: Matched shade curve in parentheses next to corresponding unit

5.1.2 Load Capacity

The load capacity for a stream under PNV is essentially the solar load allowed under the shade targets specified for the segments within that stream. These loads are determined by multiplying the solar load measured by a flat-plate collector (under full sun) for a given period of time by the fraction of the solar radiation that is not blocked by shade (i.e., the percent open or 100% minus percent shade). In other words if a shade target is 60% (or 0.6), the solar load hitting the stream under that target is 40% of the load hitting the flat-plate collector under full sun.

DEQ obtained solar load data from flat-plate collectors at the NREL weather stations in Helena, Montana, and Pocatello, Idaho. The solar load data used in this TMDL analysis are spring/summer averages (i.e., an average load for the 6-month period from April through September). As such, load capacity calculations are also based on this 6-month period, which coincides with the time of year when stream temperatures are increasing, deciduous vegetation is in leaf, and fall spawning is occurring. During this period, temperatures may affect beneficial uses such as spring and fall salmonid spawning and cold water aquatic life criteria may be exceeded during summer months. Late July and early August typically represent the period of highest stream temperatures. However, solar gains can begin early in the spring and affect not only the highest temperatures reached later in the summer but also salmonid spawning temperatures in spring and fall.

Figure 40 shows existing shade estimated in the subbasin, and Figure 41 shows the PNV shade targets. The tables in Appendix E also show corresponding target summer loads (in kilowatt-hours per square meter per day [kWh/m^2/day] and kWh/day) that serve as the load capacities for the streams. Existing and target loads in kWh/day can be summed for the entire stream or portion of stream examined in a single load analysis table. These total loads are shown at the bottom of their respective columns in each table. Because load calculations involve stream segment area calculations, the segments channel width that typically only has one or two significant figures dictates the level of significance of the corresponding loads. One significant figure in the resulting load can create rounding errors when existing and target loads are subtracted. The totals row of each load table represents total loads with two significant figures in an attempt to reduce apparent rounding errors.

5.1.3 Estimates of Existing Pollutant Loads

Regulations allow that loads "...may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading" (Water Quality Planning and Management, 40 CFR 130.2(I)). An estimate must be made for each point source. Nonpoint sources are typically estimated based on the type of sources (land use) and area (such as a subwatershed) but may be aggregated by type of source or area. To the extent possible, background loads should be distinguished from human-caused increases in nonpoint loads.

Existing loads in this temperature TMDL come from estimates of existing shade as determined from aerial photo interpretations. There are currently no permitted point sources in the affected AUs. Like target shade, existing shade was converted to a solar load by multiplying the fraction of open stream by the solar radiation measured on a flat-plate collector at the NREL weather stations. Existing shade data are presented in Appendix E. Like load capacities (target loads), existing loads are presented on an area basis (kWh/m^2/day) and as a total load (kWh/day). Existing loads in kWh/day are also summed for the entire stream or portion of stream examined in a single load analysis table. The difference between target and existing load is also summed for the entire table. Should existing load exceed target load, this difference becomes the excess load (i.e., lack of shade), discussed next in the load allocation section and depicted in Figure 42.

The AU with the largest existing load was Medicine Lodge Creek (ID 17040215SK006_04) with 1.9 million kWh/day. The smallest existing load was in the Medicine Lodge Creek tributaries AU (ID 17040215SK011_02) with 50,000 kWh/day.

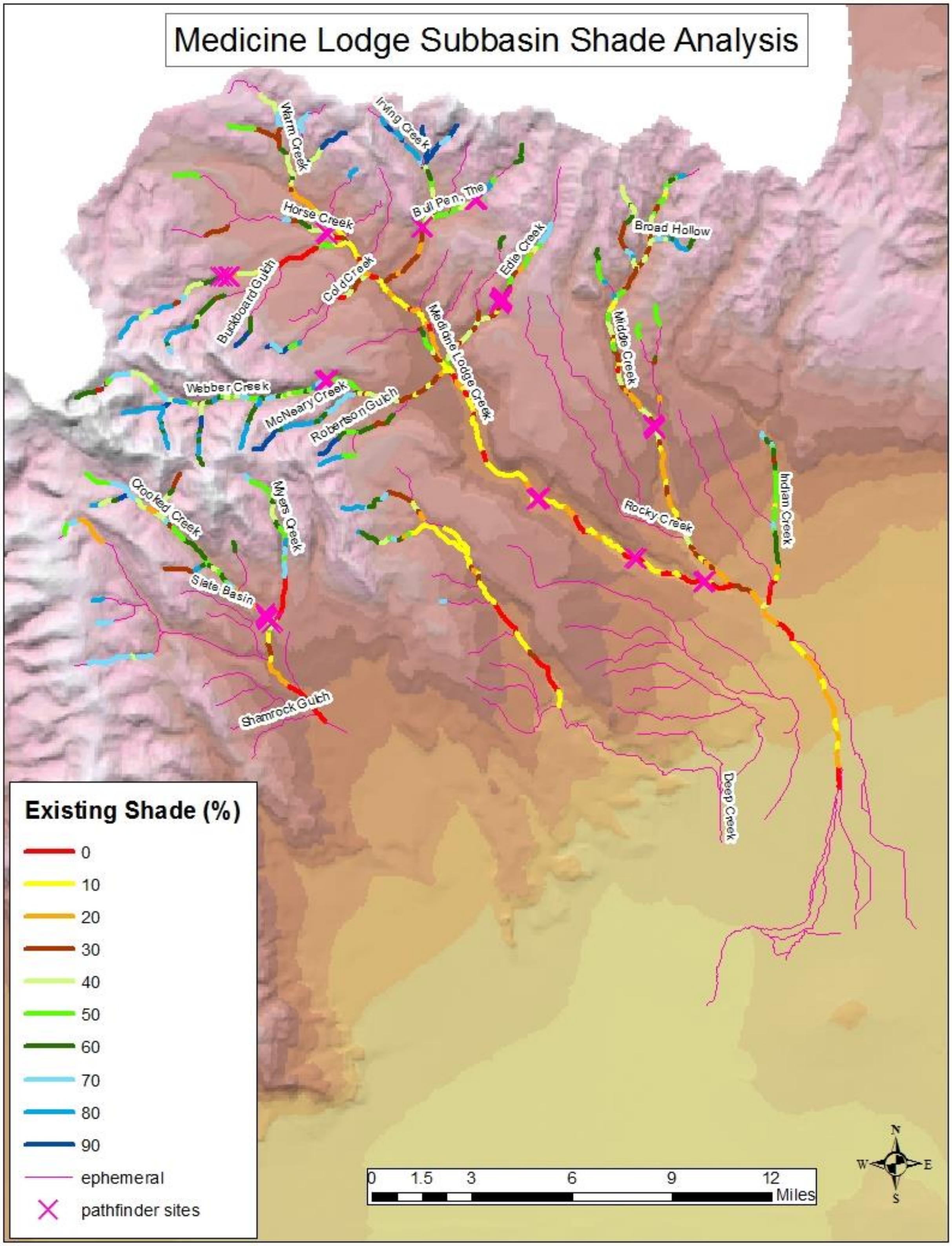


Figure 40. Existing shade estimated for the Medicine Lodge Creek subbasin by aerial photo interpretation.

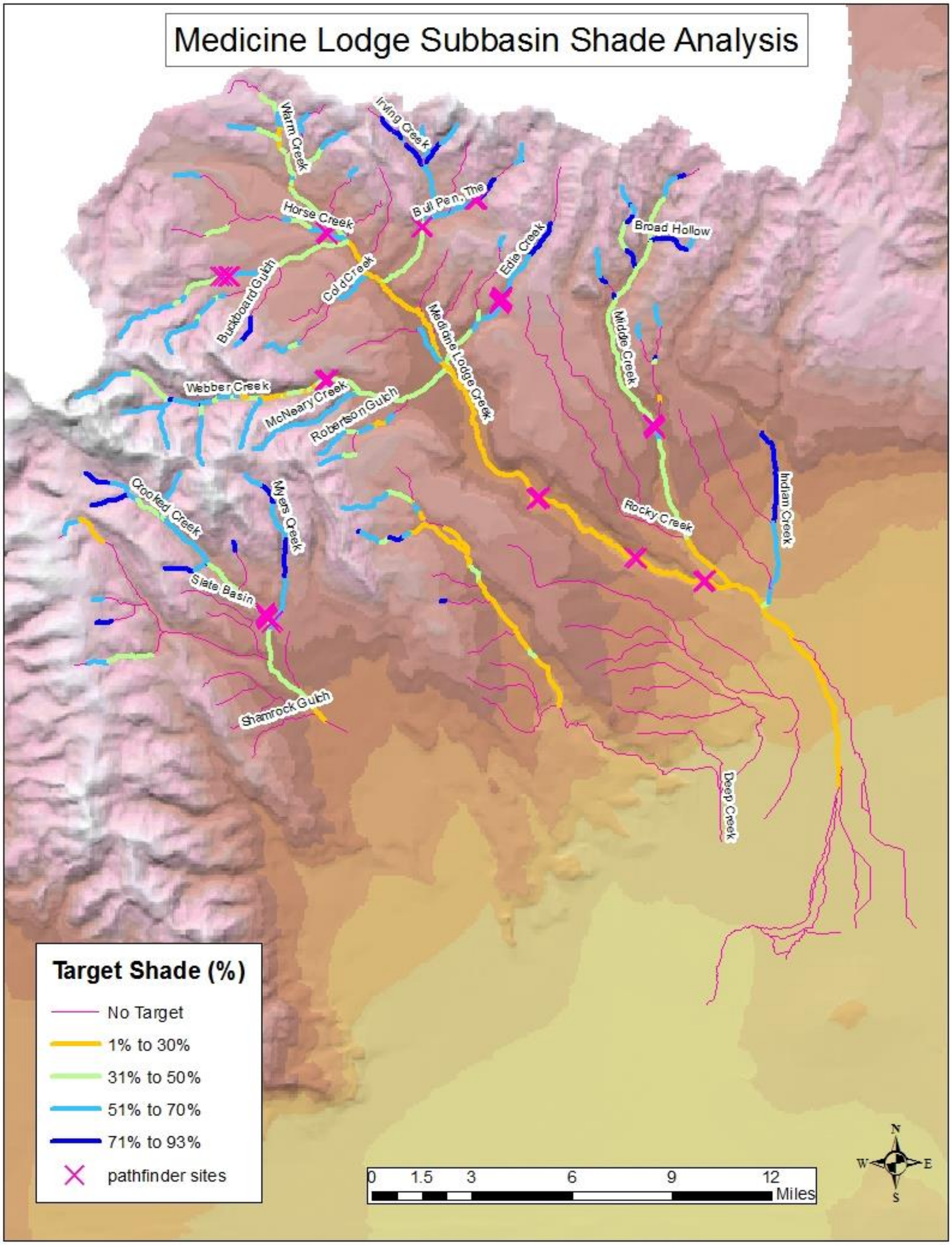


Figure 41. Target shade for the Medicine Lodge Creek subbasin.

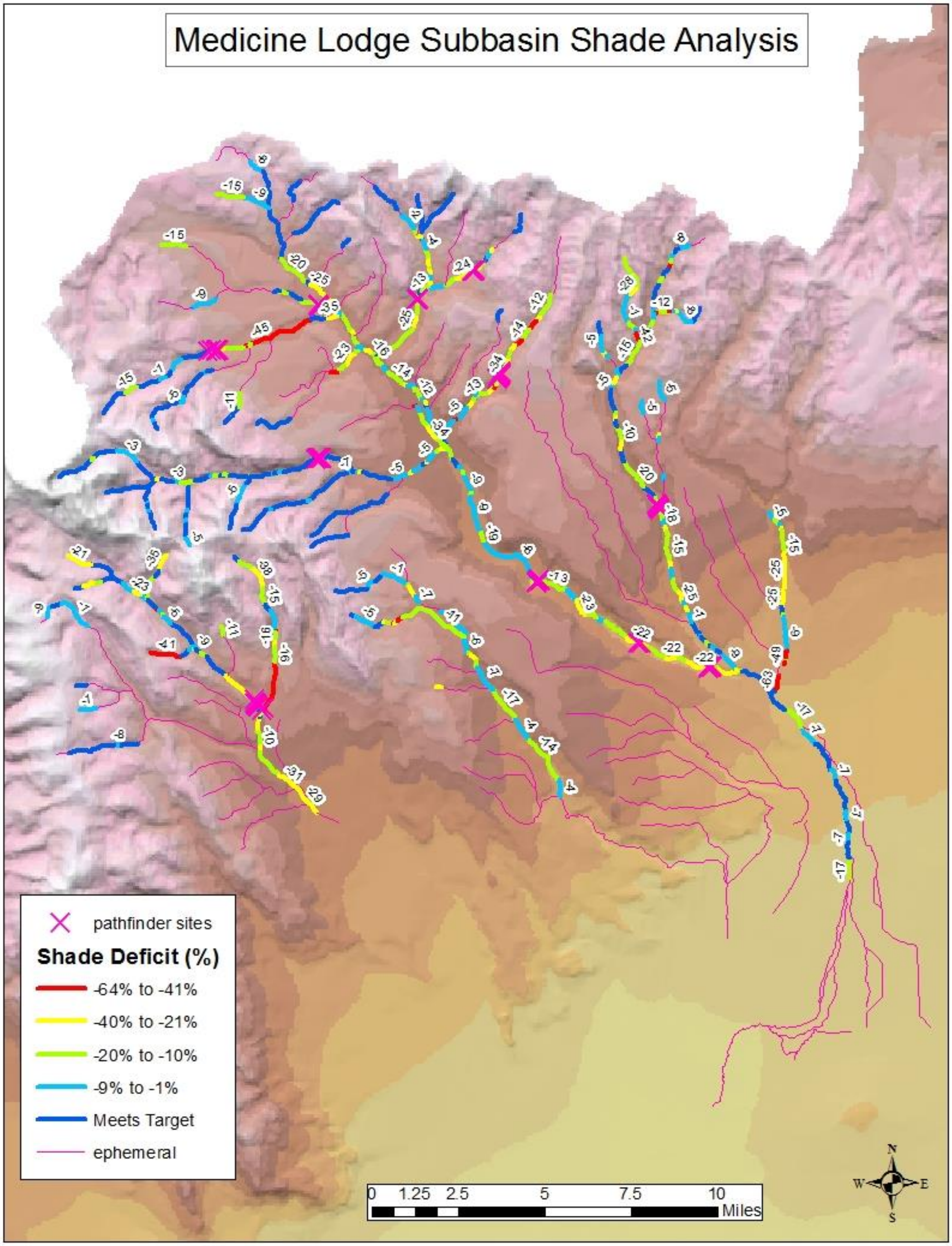


Figure 42. Lack of shade (difference between existing and target) for the Medicine Lodge Creek subbasin.

5.1.4 Load Allocation

Because this TMDL is based on PNV, which is equivalent to background load, the load allocation is essentially the desire to achieve background conditions. However, to reach that objective, load allocations are assigned to nonpoint source activities that have affected or may affect riparian vegetation and shade as a whole. Therefore, load allocations are stream segment specific and depend upon the target load for a given segment. Appendix E shows the target shade and corresponding target summer load. This target load (i.e., load capacity) is necessary to achieve background conditions. There is no opportunity to further remove shade from the stream by any activity without exceeding its load capacity. Additionally, because this TMDL is dependent upon background conditions for achieving water quality standards, all tributaries to the waters examined here need to be in natural conditions to prevent excess heat loads to the system.

Table 11 shows the total existing, target, and excess loads and the average lack of shade for each AU examined. The size of a stream influences the size of the excess load. Large streams have higher existing and target loads by virtue of their larger channel widths.

Although this TMDL analysis focuses on total solar loads, it is important to note that differences between existing and target shade, as depicted in the lack-of-shade figure (Figure 42) are the key to successfully restoring these waters to achieving water quality standards. Target shade levels for individual reaches should be the goal managers strive for with future implementation plans. Managers should focus on the largest differences between existing and target shade as locations to prioritize implementation efforts. Each load analysis table contains a column that lists the lack of shade on the stream segment. This value is derived from subtracting target shade from existing shade for each segment. Thus, stream segments with the largest lack of shade are in the worst shape. The average lack of shade derived from the last column in each load analysis table is also listed in Table 11 and provides a general level of comparison among streams.

Table 11. Total solar loads and average lack of shade for all waters.

Water Body	Assessment Unit Number	Total Existing Load	Total Target Load	Excess Load (% Reduction)	Average Lack of Shade (%)
			(kWh/day)		
Indian Creek	ID17040215SK003_02	Ephemeral	0	0 (0%)	NA
Deep Creek	ID17040215SK018_03	Ephemeral	0	0 (0%)	NA
Warm Creek	ID17040215SK013_02	97,000	110,000	0 (0%)	-2
Webber Creek	ID17040215SK017_02	370,000	430,000	0 (0%)	-4
Irving Creek	ID17040215SK012_02	77,000	68,000	8,400 (11%)	-11
Middle Creek	ID17040215SK007_03	290,000	290,000	9,000 (3%)	-11
Middle Creek	ID17040215SK008_02	150,000	140,000	9,200 (6%)	-13
Medicine Lodge Creek tributaries	ID17040215SK011_02	50,000	36,000	14,000 (28%)	-20
Horse Creek	ID17040215SK015_02	54,000	39,000	15,000 (28%)	-16
Irving Creek	ID17040215SK012_03	97,000	79,000	18,000 (19%)	-15
Warm Creek	ID17040215SK013_03	100,000	84,000	20,000 (20%)	-11
Edie Creek	ID17040215SK010_02	120,000	93,000	25,000 (21%)	-23
Middle Creek	ID17040215SK007_02	160,000	130,000	26,000 (16%)	-14
Fritz Creek	ID17040215SK016_02	200,000	170,000	32,000 (16%)	-8
Medicine Lodge Creek	ID17040215SK011_03	150,000	120,000	33,000 (22%)	-18
Deep Creek	ID17040215SK018_02	350,000	320,000	34,000 (10%)	-14
Medicine Lodge Creek	ID17040215SK011_04	390,000	350,000	39,000 (10%)	-10
Crooked Creek	ID17040215SK021_03	180,000	140,000	40,000 (22%)	-25
Medicine Lodge Creek	ID17040215SK002_04	920,000	870,000	47,000 (5%)	-4
Crooked Creek	ID17040215SK021_02	310,000	220,000	82,000 (26%)	-13
Indian Creek	ID17040215SK003_03	200,000	110,000	85,000 (43%)	-29
Medicine Lodge Creek	ID17040215SK006_04	1,900,000	1,700,000	230,000 (12%)	-11

Notes: Rounding to two significant figures may present rounding errors; kilowatt-hours per day (kWh/day); not assessed (NA)

Two AUs were ephemeral stream networks and had no loads calculated. Two additional AUs did not produce excess loads and had average lack of shade values in the single digits typical of existing shade in the same 10% class interval as its corresponding target shade. These units include the 2nd-order AUs associated with Warm Creek and Webber Creek. The largest excess loads occurred in a 4th-order segment of Medicine Lodge Creek; however, it was not necessarily the highest percent reductions needed to achieve target loads. The 3rd-order AU of Indian Creek had the highest needed reduction (43%) and the highest average lack of shade value (-29%). These data suggest that Indian Creek is the most impaired with respect to shade deficits. Lower Indian Creek is a cottonwood dominated stream with agricultural fields and irrigation demands that likely limit cottonwood riparian. Generally, 3rd-order segments are lower gradient, wider valley segments that tend to be impacted the most by agricultural activities including pasture grazing. Streams (AUs) with a high need for reductions and a high lack of shade also include the 2nd- and 3rd-orders of Crooked Creek. Crooked Creek and Deep Creek are in the driest portion of the upper subbasin and many of their tributaries are ephemeral. Livestock grazing in these dry systems can have pronounced effects on riparian communities as both depend on limited water.

The previous approved temperature TMDL (DEQ 2003) identified loads as the difference between measured existing temperatures in the streams and salmonid spawning temperature criteria from Idaho’s water quality standards. Those differences were represented as a percent reduction in temperature needed to achieve the criteria. DEQ compared these percent reductions from the older TMDL to the solar load reductions identified in Table 11 on a whole creek basis (Table 12). In general, the temperature differentials from 2003 produced higher percent reductions. DEQ also notes that streams identified in the present PNV-style temperature TMDL as having no excess load (0% reduction) or little excess load (0%–10%) did have substantial differences in the previous temperature comparison. In the case of Deep Creek, the previous temperature TMDL identified it as having the largest load reduction needed, a situation not identified in the shade analysis. Deep Creek is ephemeral in its 3rd-order AU, which would have pronounced effects on temperature as the water dries up. The 2nd-order segments of Webber Creek and Warm Creek have no excess solar loads despite having temperatures higher than criteria in the 2003 TMDL. Clearly some streams, despite adequate shade, will have stream temperatures higher than criteria.

Table 12. Comparison of percent load reductions—PNV TMDL versus 2003 temperature TMDL.

Stream	Assessment Unit(s)	PNV Load % Reduction	2003 Temperature Load % Reduction
Deep Creek	ID17040215SK018_02	0 - 10	49 - 51
Fritz Creek	ID17040215SK016_02	16	28 - 37
Warm Creek	ID17040215SK013_02	0 - 20	38 - 49
Webber Creek	ID17040215SK017_02	0	17 - 20
Indian Creek	ID17040215SK003_03	0 - 43	30 - 33
Horse Creek	ID17040215SK015_02	28	28 - 40
Middle Creek	ID17040215SK007_02 & _03	3 - 16	31 - 43
Irving Creek	ID17040215SK012_02 & _03	11 - 19	3 - 36
Crooked Creek	ID17040215SK021_02	22 - 26	25 - 32
Medicine Lodge Creek	ID17040215SK011_03 & _04, ID17040215SK006_04	5 - 28	32 - 45
Edie Creek	ID17040215SK010_02	21	23 - 34

A certain amount of excess load is potentially created by the existing shade/target shade difference inherent in the load analysis. Because existing shade is reported as a 10% shade class and target shade is a unique integer between 0% and 100%, there is usually a difference between the two. For example, say a particular stream segment has a target shade of 86% based on its vegetation type and natural bankfull width. If existing shade on that segment were at target level, it would be recorded as 80% in the load analysis because it falls into the 80% existing shade class. There is an automatic difference of 6%, which could be attributed to the margin of safety.

Water Diversion

Stream temperature may be affected by water diversion for water rights purposes. Flow diversion reduces the amount of water exposed to a given level of solar radiation in the stream channel, which can result in increased water temperature in that channel. Flow loss in the channel also affects the ability of the near-stream environment to support shade-producing vegetation, increasing solar load to the channel.

Although these water temperature effects may occur, nothing in this TMDL supersedes any water appropriation in the affected watershed. Section 101(g), the Wallop Amendment, was added to the Clean Water Act as part of the 1977 amendments to address water rights:

> It is the policy of Congress that the authority of each State to allocate quantities of water within its jurisdiction shall not be superseded, abrogated or otherwise impaired by this chapter. It is the further policy of Congress that nothing in this chapter shall be construed to supersede or abrogate rights to quantities of water which have been established by any State. Federal agencies shall co-operate with State and local agencies to develop comprehensive solutions to prevent, reduce and eliminate pollution in concert with programs for managing water resources.

Additionally, Idaho water quality standards indicate the following:

> The adoption of water quality standards and the enforcement of such standards is not intended to…interfere with the rights of Idaho appropriators, either now or in the future, in the utilization of the water appropriations which have been granted to them under the statutory procedure… (IDAPA 58.01.02.050.01)

This TMDL has not quantified what impact, if any, diversions are having on stream temperature. Water diversions are allowed for in state statute, and it is possible for a water body to be 100% allocated. Diversions notwithstanding, reaching shade targets as discussed in the TMDL will protect what water remains in the channel and allow the stream to meet water quality standards for temperature. This TMDL will lead to cooler water by achieving shade that would be expected under natural conditions and water temperatures resulting from that shade. DEQ encourages local landowners and water rights holders to voluntarily do whatever they can to help instream flow and keep channel water cooler for aquatic life.

5.1.4.1 Margin of Safety

The margin of safety in this TMDL is considered implicit in the design. Because the target is essentially background conditions, loads (shade levels) are allocated to lands adjacent to these streams at natural background levels. Because shade levels are established at natural background or system potential levels, it is unrealistic to set shade targets at higher, or more conservative, levels. Additionally, existing shade levels are reduced to the next lower 10% shade class, which likely underestimates actual shade in the load analysis. Although the load analysis used in this TMDL involves gross estimations that are likely to have large variances, load allocations are applied to the stream and its riparian vegetation rather than specific nonpoint source activities and can be adjusted as more information is gathered from the stream environment.

5.1.4.2 Seasonal Variation

This TMDL is based on average summer loads. All loads have been calculated to include the 6-month period from April through September. This time period is when the combination of increasing air and water temperatures coincide with increasing solar inputs and vegetative shade. The critical time periods are April through June when spring salmonid spawning occurs, July and August when maximum temperatures may exceed cold water aquatic life criteria, and September when fall salmonid spawning is most likely to be affected by higher temperatures. Water temperature is not likely to be a problem for beneficial uses outside of this time period because of cooler weather and lower sun angle.

5.2 Bacteria TMDLs

Bacteria TMDLs are developed for four AUs in the Medicine Lodge Creek subbasin. Exceedances of the geometric mean of five samples taken 3 to 7 days apart over a 30-day period occur for the following:

- Warm Creek (i.e., Divide Creek) (ID17040215SK013_03): geometric mean = 338.7 cfu/100 mL (**Note**: According to the 2010 Integrated Report, bacteria sampling for Divide Creek (ID17040215SK014_02) was collected downstream in the Warm Creek AU (ID17040215SK013_03) where there was water).
- Middle Creek (ID17040215SK007_03): geometric mean = 1,235.6 cfu/100 mL
- Medicine Lodge Creek (ID17040215SK006_04): geometric mean = 464.7 cfu/100 mL

Sampling for West Fork Indian Creek (ID17040215SK005_02) did not follow the protocol for calculating compliance with the water quality standard and only four samples rather than five were taken. However, even if the fifth sample was near zero concentration, the geometric mean would still equal 208 cfu/100 mL, so a bacteria TMDL will be provided for West Fork Indian Creek based on 208 cfu/100 mL.

5.2.1 Instream Water Quality Targets

Bacteria targets are set by Idaho’s water quality standards (IDAPA 58.01.02.251.01). The numeric criterion for *E. coli* is not to exceed 126 *E. coli*/100 mL based on the geometric mean of five samples taken 3 to 7 days apart and collected at evenly spaced intervals over a 30-day period. A geometric mean is applied to minimize random variability in data associated with surface waters prone to short-term episodic spikes in bacteria concentrations. This criterion applies to both primary and secondary contact recreation.

5.2.1.1 Design Conditions

The *E. coli* target should be met at all times. To protect beneficial uses, load allocations are calculated for critical low flow conditions. The only impaired AU with enough streamflow data to calculate critical low flow is Medicine Lodge Creek (ID17040215SK006_04).

The percentile flow values for the entire period of record are shown in Figure 43.

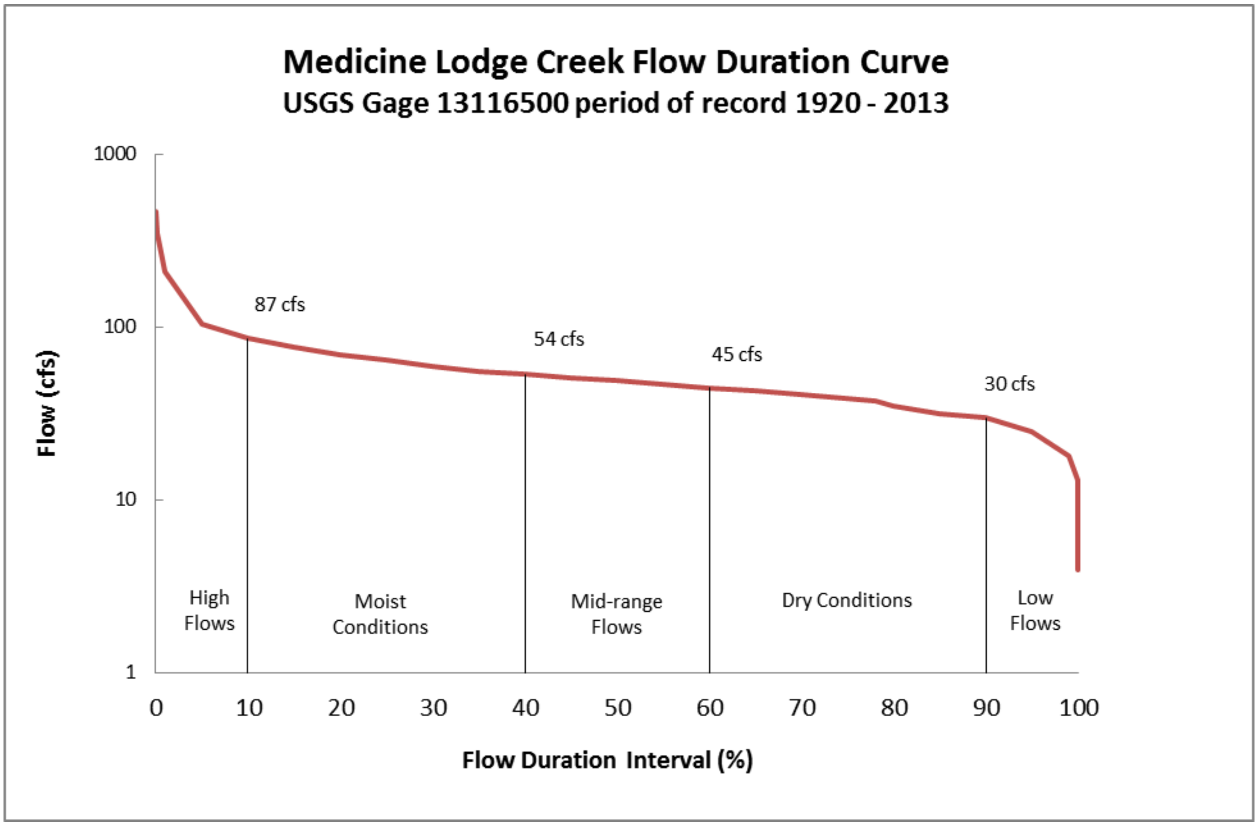


Figure 43. Flow duration curve for Medicine Lodge Creek USGS gage 13116500.

Using flow duration intervals to describe these five hydrological periods is based on the work of Bruce Cleland (EPA 2007). Analyzing the flow data for this subbasin, the hydrologic periods based on flow data in the entire period of record equal the following:

- Low flows: 4–29 cfs—do not occur in the average year
- Dry conditions: 30–44 cfs—occur in the winter from late November through mid-February
- Midrange flows: 45–53 cfs—occur in the spring from mid-February through March and in the fall from August 25 through November 26
- Moist conditions: 54–86 cfs—occur from April 1 through May 17 and from July 1 through August 24
- High flows: 87–470 cfs—occur from May 18 through June 30

The hydrological analysis used to produce this information is provided in Appendix A.

Since historic low flows do not occur in the average year, 30 cfs will be used as the critical low flow for calculating the *E. coli* load capacity in this AU.

The other bacteria-impaired AUs do not have any streamflow data for any period of record, but the US Geological Survey (USGS) tool StreamStats (Hortness and Berenbrock 2001) can be used to statistically estimate discharge at an ungauged location. The low-flow values were validated with instantaneous streamflow measurements collected at BURP sites. The critical low flows for calculating the *E. coli* load capacities are provided in Table 13.

Table 13. Critical low flow for calculating *E. coli* bacteria load capacities.

Stream Name	Assessment Unit Number	Critical Low Flow (cubic feet per second)	Calculation Method
West Fork Indian Creek	ID17040215SK005_02	8	StreamStats estimations validated with BURP data
Medicine Lodge Creek	ID17040215SK006_04	30	90th percentile flow from flow duration curve developed from USGS gage 13116500 with a period of record from 1920 through 2013
Middle Creek	ID17040215SK007_03	4	StreamStats estimations validated with BURP data
Warm Creek (i.e, Divide Creek)[a]	ID17040215SK013_03	3	StreamStats estimations validated with BURP data

a. According to the 2010 Integrated Report, bacteria sampling for Divide Creek (ID17040215SK014_02) was collected downstream in the Warm Creek AU (ID17040215SK013_03) where there was water.
Notes: Beneficial Use Reconnaissance Program (BURP); US Geological Survey (USGS)

5.2.1.2 Water Quality Monitoring Points

Impaired AUs will be monitored for compliance with the *E. coli* criterion at locations where exceedances were originally measured. Figure 44 shows the bacteria monitoring locations. These sites should be monitored during the critical periods when cattle are present. The Dubois Ranger District of the Caribou-Targhee National Forest and BLM Upper Snake Field Office operate grazing allotments in the subbasin and issue annual operating instructions every year to identify the seasons for pasture rotation. For instance, the Medicine Lodge Cattle and Horse Allotment for 2013 identified a pasture rotation schedule that used the Divide Creek pasture from August 16 to October 18. Water quality monitoring should be coordinated with these grazing allotment schedules to capture critical periods. The grazing allotment for each monitoring location is as follows:

- Divide Creek (Warm Creek AU) bacteria monitoring location at N 44.444, W -112.688—Warm Creek grazing allotment
- West Fork Indian Creek bacteria monitoring location at N44.414, W -112.428—Indian Creek grazing allotment
- Middle Creek bacteria monitoring location at N 44.290, W -112.457—Canyon grazing allotment
- Medicine Lodge Creek bacteria monitoring location at N 44.288, W -112.497—Edie, Ellis, and Canyon Creeks grazing allotments.

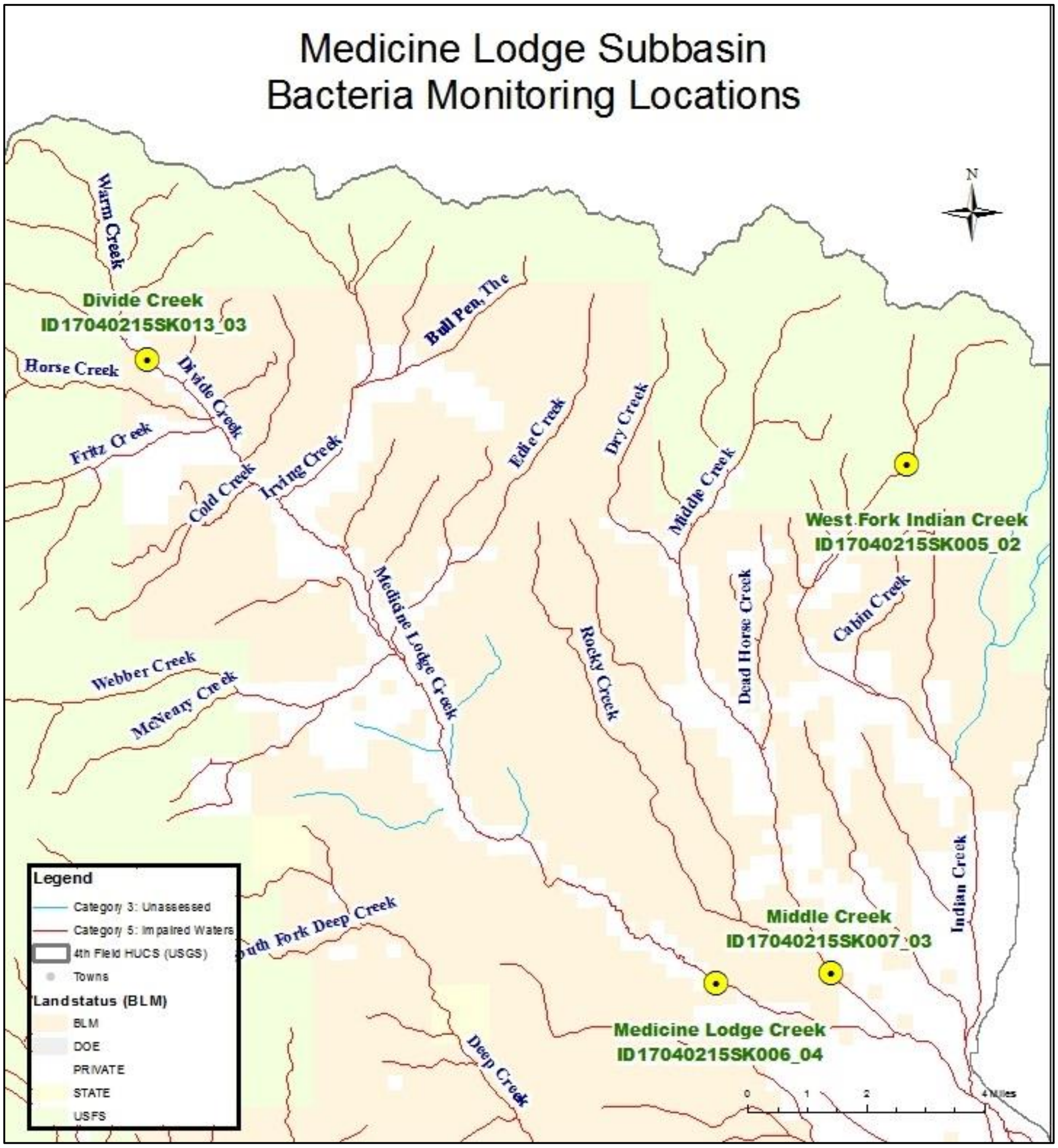


Figure 44. *E. coli* bacteria monitoring locations in Medicine Lodge Creek subbasin.

These monitoring locations are selected to be nearest to the original point of data collection and to be the most downstream point that is located on public lands.

5.2.2 Load Capacity

In bacteria TMDLs, the water quality standard is the load capacity of a system. The load capacity is based on critical low flows. The load capacity is calculated as a function of 126 cfu/100 mL as the target and the low flow of the monitored AU according to the following example calculation:

$$E. coli\ load\ capacity = \frac{126\ cfu\ \times x\ cf\ \times 86400\ seconds\ \times 1\ mL}{100\ mL\ \times 1\ second\ \times 1\ day\ \times 0.000353\ cf} = x\ cfu/day$$

where:

126 colony forming units (cfu) /100 milliliters (mL) is the *E. coli* target
x cubic feet per second (cfs) is the critical low flow
864,000 seconds per day is the time conversion
1 mL per 0.000353 cubic feet (cf) is the volume conversion

Table 14 provides the load capacities for the AUs with *E. coli* exceedances.

Table 14. *E. coli* bacteria load capacities calculated on critical low flow.

Stream Name	Assessment Unit Number	Critical Low Flow (cfs)	Target Concentration (cfu/100 mL)	Load Capacity (cfu/day, or cfu^9/day)
West Fork Indian Creek	ID17040215SK005_02	8	126	2,467,172,804 cfu/day, or 24.67 cfu^9/day
Medicine Lodge Creek	ID17040215SK006_04	30	126	9,251,898,017 cfu/day, or 92.52 cfu^9/day
Middle Creek	ID17040215SK007_03	4	126	1,233,586,402 cfu/day, or 12.34 cfu^9/day
Warm Creek (i.e., Divide Creek)[a]	ID17040215SK013_03	3	126	925,189,802 cfu/day, or 9.25 cfu^9/day

a. According to the 2010 Integrated Report, bacteria sampling for Divide Creek (ID17040215SK014_02) was collected downstream in the Warm Creek AU (ID17040215SK013_03) where there was water.
Notes: Cubic feet per second (cfs); colony forming units per 100 milliliters (cfu/100 mL); billion colony forming units per day (cfu9/day)

5.2.3 Estimates of Existing Pollutant Loads

Regulations allow that loads "...may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading" (40 CFR 130.2(g)). The existing pollutant load is based on the most recent bacteria data. Table 15 provides the existing pollutant loads for the AUs with *E. coli* exceedances calculated on the critical low flow.

Table 15. *E. coli* bacteria existing pollutant loads calculated on critical low flow.

Stream Name	Assessment Unit Number	Critical Low Flow (cfs)	Measured Concentration (cfu/100 mL)	Existing Pollutant Load (cfu/day, or cfu^9/day)
West Fork Indian Creek	ID17040215SK005_02	8	208	4,072,793,201 cfu/day, or 40.73 cfu^9/day
Medicine Lodge Creek	ID17040215SK006_04	30	464.7	34,121,881,010 cfu/day, or 341.22 cfu^9/day
Middle Creek	ID17040215SK007_03	4	1,235.6	12,096,979,037 cfu/day, or 120.97 cfu^9/day
Warm Creek (i.e., Divide Creek)[a]	ID17040215SK013_03	3	338.7	2,486,998,300 cfu/day, or 24.87 cfu^9/day

a. According to the 2010 Integrated Report, bacteria sampling for Divide Creek (ID17040215SK014_02) was collected downstream in the Warm Creek AU (ID17040215SK013_03) where there was water.
Notes: Cubic feet per second (cfs); colony forming units per 100 milliliters (cfu/100 mL); billion colony forming units per day (cfu9/day)

5.2.4 Load Allocations

Table 16 lists the *E. coli* load allocations and necessary load reductions for the AUs with measured concentrations exceeding the standard. The load allocations include a 10% margin of safety and an additional 10% allocation to natural background sources in the subbasin.

Table 16. Nonpoint source *E. coli* bacteria load allocations for Medicine Lodge Creek subbasin.

Stream Name and Assessment Unit Number	Load Capacity	Natural Background	Margin of Safety	Load Allocation	Total Existing Load	Load Reduction	Percent Reduction (%)
West Fork Indian Creek (ID17040215SK005_02) -concentration (cfu/mL)	126	13	13	100	208	108	52
-load (cfu^9/day)	24.7	2.47	2.47	19.74	40.73	20.99	
Medicine Lodge Creek (ID17040215SK006_04) -concentration (cfu/mL)	126	13	13	100	464.7	364.7	78
-load (cfu^9/day)	92.5	9.25	9.25	74.02	341.22	267.20	
Middle Creek (ID17040215SK007_03) -concentration (cfu/mL)	126	13	13	100	1,235.6	1,135.6	92
-load (cfu^9/day)	12.34	1.23	1.23	9.87	120.97	111.10	
Warm Creek (i.e., Divide Creek)[a](ID17040215SK013_03) -concentration (cfu/100 mL)	126	13	13	100	338.7	238.7	70
-load (cfu^9/day)	9.25	0.93	0.93	7.40	24.87	17.47	

a. According to the 2010 Integrated Report, bacteria sampling for Divide Creek (ID17040215SK014_02) was collected downstream in the Warm Creek AU (ID17040215SK013_03) where there was water.
Notes: Colony forming units per 100 milliliters (cfu/100 mL); billion colony forming units per day (cfu^9/day)

5.2.4.1 Margin of Safety and Natural Background

Establishing a TMDL requires that a margin of safety be identified to account for uncertainty. A margin of safety is expressed as either an implicit or explicit portion of a water body's load capacity that is reserved to allow for uncertainty about the relationship between the pollutant loads and the quality of the receiving water body. The margin of safety is not allocated to any sources of a pollutant. DEQ has added an explicit 10% margin of safety to the required load reduction to ensure the secondary contact beneficial use is supported throughout the year.

In addition, natural background sources of *E. coli* are inherent to the Medicine Lodge Creek subbasin. Wildlife, including birds, elk, deer, and moose are present, especially in the high-mountain 1st- and 2nd-order streams near the Continental Divide. There has been no budget to evaluate the *E. coli* samples for genetic sourcing, so to be conservative, an additional 10% of the bacterial load is allocated to natural background sources.

5.2.4.2 Seasonal Variation

The *E. coli* bacteria allocations apply daily throughout the year because secondary contact recreation (i.e., wading) may occur at any time of the year. Meeting this allocation ensures water quality standards are attained for the protection of public health. Future monitoring should occur during critical low flows and when grazing allotments are most active.

5.2.4.3 Reasonable Assurance

Land uses in Medicine Lodge Creek subbasin are solely agricultural, consisting of rangeland uses in the bacteria-impaired AUs. The Dubois Ranger District of the Caribou-Targhee National Forest and BLM Upper Snake Field Office operate grazing allotments in the subbasin and issue annual operating instructions every year to identify the seasons for pasture rotation. These instructions include proposed pasture rotations to preclude excess impacts to streambanks and list the improvements—such as exclusion fencing and off-site watering—that must be maintained before livestock enter the allotment. Additionally, the Clark SCD actively works with landowners to target riparian areas that are most sensitive to impairments.

5.2.5 Construction Stormwater and TMDL Wasteload Allocations

Stormwater runoff is water from rain or snowmelt that does not immediately infiltrate into the ground and flows over or through natural or man-made storage or conveyance systems. When undeveloped areas are converted to land uses with impervious surfaces—such as buildings, parking lots, and roads—the natural hydrology of the land is altered and can result in increased surface runoff rates, volumes, and pollutant loads. Certain types of stormwater runoff are considered point source discharges for Clean Water Act purposes, including stormwater that is associated with municipal separate storm sewer systems (MS4s), industrial stormwater covered under the Multi-Sector General Permit (MSGP), and construction stormwater covered under the Construction General Permit (CGP).

5.2.5.1 Municipal Separate Storm Sewer Systems

Polluted stormwater runoff is commonly transported through MS4s, from which it is often discharged untreated into local water bodies. An MS4, according to (40 CFR 122.26(b) (8)), is a conveyance or system of conveyances that meets the following criteria:

- Owned by a state, city, town, village, or other public entity that discharges to waters of the United States.
- Designed or used to collect or convey stormwater (including storm drains, pipes, and ditches)
- Not a combined sewer
- Not part of a publicly owned treatment works (sewage treatment plant)

No MS4s exist in the Medicine Lodge Creek subbasin.

5.2.5.2 Industrial Stormwater Requirements

Stormwater runoff picks up industrial pollutants and typically discharges them into nearby water bodies directly or indirectly via storm sewer systems. When facility practices allow exposure of industrial materials to stormwater, runoff from industrial areas can contain toxic pollutants (e.g., heavy metals and organic chemicals) and other pollutants such as trash, debris, and oil and grease. This increased flow and pollutant load can impair water bodies, degrade biological habitats, pollute drinking water sources, and cause flooding and hydrologic changes, such as channel erosion, to the receiving water body.

Multi-Sector General Permit and Stormwater Pollution Prevention Plans

In Idaho, if an industrial facility discharges industrial stormwater into waters of the United States, the facility must be permitted under EPA’s most recent MSGP. To obtain an MSGP, the facility must prepare a stormwater pollution prevention plan (SWPPP) before submitting a notice of intent for permit coverage. The SWPPP must document the site description, design, and installation of control measures; describe monitoring procedures; and summarize potential pollutant sources. A copy of the SWPPP must be kept on site in a format that is accessible to workers and inspectors and be updated to reflect changes in site conditions, personnel, and stormwater infrastructure.

Industrial Facilities Discharging to Impaired Water Bodies

Any facility that discharges to an impaired water body must monitor all pollutants for which the water body is impaired and for which a standard analytical method exists (40 CFR 136).

Also, because different industrial activities have sector-specific types of material that may be exposed to stormwater, EPA grouped the different regulated industries into 29 sectors, based on their typical activities. Part 8 of EPA’s MSGP details the stormwater management practices and monitoring that are required for the different industrial sectors.

TMDL Industrial Stormwater Requirements

When a stream is on Idaho’s §303(d) list and has a TMDL developed, DEQ may incorporate a wasteload allocation for industrial stormwater activities under the MSGP. However, most load analyses developed in the past have not identified sector-specific numeric wasteload allocations for industrial stormwater activities. Industrial stormwater activities are considered in compliance with provisions of the TMDL if operators obtain an MSGP under the NPDES program and implement the appropriate BMPs. Typically, operators must also follow specific requirements to be consistent with any local pollutant allocations. The next MSGP will have specific monitoring requirements that must be followed. Currently there are no known MSGPs in the Medicine Lodge Creek subbasin.

5.2.5.3 Construction Stormwater

The Clean Water Act requires operators of construction sites to obtain permit coverage to discharge stormwater to a water body or municipal storm sewer. In Idaho, EPA has issued a general permit for stormwater discharges from construction sites.

Construction General Permit and Stormwater Pollution Prevention Plans

If a construction project disturbs more than 1 acre of land (or is part of a larger common development that will disturb more than 1 acre), the operator is required to apply for a CGP from EPA after developing a site-specific SWPPP. The SWPPP must provide for the erosion, sediment, and pollution controls they intend to use; inspection of the controls periodically; and maintenance of BMPs throughout the life of the project. Operators are required to keep a current copy of their SWPPP on site or at an easily accessible location.

TMDL Construction Stormwater Requirements

When a stream is on Idaho's §303(d) list and has a TMDL developed, DEQ may incorporate a gross wasteload allocation for anticipated construction stormwater activities. Most loads developed in the past did not have a numeric wasteload allocation for construction stormwater activities. Construction stormwater activities are considered in compliance with provisions of the TMDL if operators obtain a CGP under the NPDES program and implement the appropriate BMPs. Typically, operators must also follow specific requirements to be consistent with any local pollutant allocations. The CGP has monitoring requirements that must be followed.

Postconstruction Stormwater Management

Many communities throughout Idaho are currently developing rules for postconstruction stormwater management. Sediment is usually the main pollutant of concern in construction site stormwater. DEQ's *Catalog of Stormwater Best Management Practices for Idaho Cities and Counties* (DEQ 2005) should be used to select the proper suite of BMPs for the specific site, soils, climate, and project phasing to sufficiently meet the standards and requirements of the CGP to protect water quality. Where local ordinances have more stringent and site-specific standards, those are applicable.

5.2.6 Reserve for Growth

A growth reserve is not included in this TMDL. The load capacities have been allocation to the existing nonpoint sources in the watershed. No new sources are expected, but any new source will be required to meet the requirements of this TMDL.

5.3 Implementation Strategies

DEQ recognizes that implementation strategies for TMDLs may need to be modified if monitoring shows that TMDL goals are not being met or significant progress is not being made toward achieving the goals. Reasonable assurance (section 5.2.4.3) for the TMDL to meet water quality standards is based on the implementation strategy.

Implementation strategies for TMDLs produced using PNV-based shade and solar loads should incorporate the load analysis tables presented in Appendix E of this TMDL. These tables need to be updated, first to field verify the remaining existing shade levels and second to monitor progress toward achieving reductions and TMDL goals. Using the Solar Pathfinder to measure existing shade levels in the field is important to achieving both objectives. It is likely that further field verification will find discrepancies with reported existing shade levels in the load analysis tables. Due to the inexact nature of the aerial photo interpretation technique, these tables should not be viewed as complete until verified. Implementation strategies should include Solar Pathfinder monitoring to simultaneously field verify the TMDL and mark progress toward achieving desired load reductions.

DEQ recognizes that implementation strategies for TMDLs may need to be modified if monitoring shows that TMDL goals are not being met or significant progress is not being made toward achieving the goals. There may be a variety of reasons that individual stream segments do not meet shade targets, including natural phenomena (e.g., beaver ponds, springs, wet meadows, and past natural disturbances) and/or historic land-use activities (e.g., logging, grazing, and mining). It is important that existing shade for each stream segment be field verified to determine if shade differences are real and result from activities that are controllable. Information within this TMDL (maps and load analysis tables) should be used to guide and prioritize implementation investigations. The information in this TMDL may need further adjustment to reflect new information and conditions in the future.

5.3.1 Time Frame

Implementation of this TMDL relies on riparian area management practices that will provide a mature canopy cover to shade the stream and prevent excess solar load. Because implementation is dependent on mature riparian communities to substantially improve stream temperatures, DEQ believes 10–20 years may be a reasonable amount time for achieving water quality standards. Shade targets will not be achieved all at once. Given their smaller bankfull widths, targets for smaller streams may be reached sooner than those for larger streams.

DEQ and the designated watershed advisory group will continue to reevaluate TMDLs on a 5-year cycle. During the 5-year review, implementation actions completed, in progress, and planned will be reviewed, and pollutant load allocations will be reassessed accordingly.

5.3.2 Approach

The TMDLs developed in this document will focus on implementing load allocations for temperature and bacteria. Implementation plans that have been in place since the original TMDL (DEQ 2003) have helped inform many watershed improvement projects that have been completed or are ongoing in the Medicine Lodge Creek subbasin. The 2002 TMDL implementation plan for agriculture was developed into a project funded by a Clean Water Act §319 grant, subgrant number S051, in Medicine Lodge, Edie, Irving, and Fritz Creeks. The BLM Upper Snake Field Office provided an implementation plan to document past land management improvement actions and planned strategies for meeting TMDL load allocations (BLM 2006). This plan identifies watershed improvement projects and long-term monitoring.

The Clark SCD continues to work with landowners to identify appropriate BMPs to establish healthy riparian plant communities to increase shading to the streams that have been identified as temperature impaired. The BLM Upper Snake Field Office and the Caribou-Targhee National Forest, Dubois Ranger District manage riparian grazing and will continue to work toward reducing livestock impacts to the streams.

5.3.3 Responsible Parties

Idaho Code §39-3612 states designated management agencies are to use TMDL processes for achieving water quality standards. DEQ will rely on the designated management agencies to implement pollution control measures or BMPs for those pollutant sources identified as priorities.

DEQ also recognizes the authorities and responsibilities of city and county governments as well as applicable state and federal agencies and will enlist their involvement and authorities for protecting water quality.

The designated state agencies listed below are responsible for assisting and providing technical support for developing specific implementation plans as well as other appropriate support for water quality projects. General responsibilities for Idaho-designated management agencies are as follows:

- Idaho Soil and Water Conservation Commission: grazing and agriculture
- Idaho State Department of Agriculture: aquaculture and animal feeding operations
- Idaho Transportation Department: public roads
- Idaho Department of Lands: timber harvest, oil and gas exploration, and mining
- Idaho Department of Water Resources: stream channel alteration activities
- Idaho Department of Environmental Quality: all other activities

5.3.4 Implementation Monitoring Strategy

Effective shade monitoring can take place on any segment throughout the 22 AUs and be compared to existing shade estimates seen in Figure 40 and described in Appendix E, Tables E-4 to E-25. Those areas with the largest disparity between existing and target shade should be monitored with Solar Pathfinders to verify existing shade levels and determine progress toward meeting shade targets. Since many existing shade estimates have not been field verified, they may require adjustment during the implementation process. Stream segment length for each estimate of existing shade varies depending on the land use or landscape that has affected that shade level. It is appropriate to monitor within a given existing shade segment to see if that segment has increased its existing shade toward target levels. Ten equally spaced Solar Pathfinder measurements averaged together within that segment should suffice to determine new shade levels in the future.

6 Conclusions

Effective shade targets are established for 22 AUs based on the concept of maximum shading under PNV resulting in natural background temperature levels. Shade targets were derived from effective shade curves developed for similar vegetation types in Idaho. Existing shade was determined from aerial photo interpretation. Target and existing shade levels were compared to determine the amount of shade needed to bring water bodies into compliance with temperature criteria in Idaho's water quality standards (IDAPA 58.01.02).

Four assessment units had no excess loads and are thus in good condition with respect to shade. The larger 4th-order AU of Medicine Lodge Creek had the highest excess loads; however, proportionally they were not the highest load reductions. Third-order segments of several tributary streams showed the highest percentage of load reductions needed to achieve target loads. This is consistent with lower gradient, broader valleys that tend to be used for agricultural purposes, especially pasture grazing.

Target shade levels for individual stream segments should be the goal managers strive for with future implementation plans. Managers should focus on the largest differences between existing and target shade as locations to prioritize implementation efforts.

Based on *E. coli* monitoring throughout the subbasin, bacteria TMDLs are provided for four AUs, one of which was previously unlisted for bacteria.

Investigations of listings for combined biota/habitat bioassessment and sediment found very little sediment erosion from streambanks. More work needs to be done to update bioassessment status and to investigate sediment fines in other parts of affected AUs.

Table 17 summarizes the assessment outcomes for waters listed in Category 5 of the 2012 Integrated Report, and Table 18 lists the results for previously unlisted but impaired AUs.

Table 17. Summary of assessment outcomes.

Assessment Unit Name	Assessment Unit Number	Pollutant	TMDL Completed	Recommended Changes to Next Integrated Report	Justification
Medicine Lodge Creek—Indian Creek to playas	ID17040215SK002_04	Temperature	Yes	Keep in Category 4a for temperature	Temperature TMDL revised based on PNV
Indian Creek—confluence of West and East Forks Indian Creek to mouth	ID17040215SK003_02	Temperature	Yes	Keep in Category 4a for temperature	Temperature TMDL revised based on PNV
Indian Creek—confluence of West and East Forks Indian Creek to mouth	ID17040215SK003_03	Temperature	Yes	Keep in Category 4a for temperature	Temperature TMDL revised based on PNV
West Fork Indian Creek—source to mouth	ID17040215SK005_02	Combined biota/habitat bioassessments; *E. coli*	Yes for *E. coli*	List in Category 4a for *E. coli*; keep in Category 5 for combined biota/habitat bioassessment	*E. coli* TMDL completed
Medicine Lodge Creek—Edie Creek to Indian Creek	ID17040215SK006_04	*E. coli; t*emperature	Yes	List in Category 4a for *E. coli;* keep in Category 4a for temperature	*E. coli* TMDL completed—unlisted but impaired; temperature TMDL revised based on PNV
Middle Creek—Dry Creek to mouth	ID17040215SK007_02	Sedimentation/siltation; temperature	Yes for temperature	List in Category 4a for temperature; delist sedimentation/siltation	Temperature TMDL completed based on PNV; sediment listed in error
Middle Creek—Dry Creek to mouth	ID17040215SK007_03	Fecal coliform; temperature	Yes for temperature and *E. coli*	List in Category 4a for *E. coli* and temperature; delist for fecal coliform	Temperature TMDL revised based on PNV; *E. coli* TMDL completed
Middle Creek—source to Dry Creek	ID17040215SK008_02	Sedimentation/siltation; temperature	Yes for temperature	Keep in Category 4a for temperature; keep in Category 5 for sedimentation/siltation	Temperature TMDL completed based on PNV
Dry Creek—source to mouth	ID17040215SK009_02	Sedimentation/siltation	No	List in Category 2	Sediment data do not support listing
Edie Creek—source to mouth	ID17040215SK010_02	*E. coli;* temperature; sediment	Yes for temperature	List in Category 4a for temperature and sediment; delist for *E. coli*	Temperature TMDL completed based on PNV; delist *E. coli* due to attainment
Medicine Lodge Creek—confluence of Warm and Fritz Creeks to Edie Creek	ID17040215SK011_02	Temperature	Yes	Keep in Category 4a for temperature	Temperature TMDL revised based on PNV
Medicine Lodge Creek—confluence of Warm and Fritz Creeks to Edie Creek	ID17040215SK011_03	Temperature	Yes	Keep in Category 4a for temperature	Temperature TMDL revised based on PNV
Medicine Lodge Creek—confluence of Warm and Fritz Creeks to Edie Creek	ID17040215SK011_04	Temperature	Yes	Keep in Category 4a for temperature	Temperature TMDL revised based on PNV

Assessment Unit Name	Assessment Unit Number	Pollutant	TMDL Completed	Recommended Changes to Next Integrated Report	Justification
Irving Creek—source to mouth	ID17040215SK012_02	*E. coli;* temperature	Yes for temperature	List in Category 4a for temperature; delist for *E. coli*	Temperature TMDL completed based on PNV; delist *E. coli* due to attainment
Irving Creek—source to mouth	ID17040215SK012_03	Temperature	Yes	Keep in Category 4a for temperature	Temperature TMDL revised based on PNV
Warm Creek—source to mouth	ID17040215SK013_02	Sedimentation/siltation; temperature	Yes for temperature	List in Category 4a for temperature; keep in Category 5 for sedimentation/siltation	Temperature TMDL completed based on PNV
Warm Creek—source to mouth (i.e., Divide Creek below the confluence of Warm and Divide)[a]	ID17040215SK013_03	Sedimentation/siltation; temperature; *E. coli*	Yes for temperature and *E. coli*	List in Category 4a for temperature and *E. coli*; keep in Category 5 for sedimentation/siltation	Temperature TMDL completed based on PNV; *E.coli* TMDL completed; bacteria sampling that resulted in *E. coli* listing in 014_02 occurred in this AU
Divide Creek—source to mouth (i.e., source to Warm Creek)	ID17040215SK014_02[a]	Combined biota/habitat bioassessments; *E. coli*	No	List in Category 2; delist for combined biota/habitat bioassessments and *E. coli*	Delist combined biota/habitat bioassessment and *E. coli* due to assessment errors
Horse Creek—source to mouth	ID17040215SK015_02	Combined biota/habitat bioassessments; sedimentation/siltation; temperature	Yes for temperature	List in Category 4a for temperature; keep in Category 5 for combined biota/habitat bioassessments and sedimentation/siltation	Temperature TMDL completed based on PNV
Fritz Creek—source to mouth	ID17040215SK016_02	Temperature	Yes	Keep in Category 4a for temperature	Temperature TMDL revised based on PNV
Webber Creek	ID17040215SK017_02	Temperature	Yes	Keep in Category 4a for temperature	Temperature TMDL revised based on PNV
Deep Creek—source to mouth	ID17040215SK018_02	Combined biota/habitat bioassessments; sedimentation/siltation; temperature	Yes for temperature	List in Category 4a for temperature; keep in Category 5 for combined biota/habitat bioassessments and sedimentation/siltation	Temperature TMDL completed based on PNV
Deep Creek—source to mouth	ID17040215SK018_03	Sedimentation/siltation; temperature	Yes for temperature	List in Category 4a for temperature; delist for sedimentation/siltation	Temperature TMDL completed based on PNV; delist sediment—temperature is sole impairment
Crooked Creek—source to mouth	ID17040215SK021_02	Combined biota/habitat bioassessments; sedimentation/siltation; *E. coli;* temperature	Yes for temperature	List in Category 4a for temperature; keep in Category 5 for combined biota/habitat bioassessments and sedimentation/siltation; delist for *E. coli*	Temperature TMDL completed based on PNV; delist *E. coli* for attainment
Crooked Creek—source to mouth	ID17040215SK021_03	Temperature	Yes	Keep in Category 4a for temperature	Temperature TMDL revised based on PNV

a. According to the 2010 Integrated Report, bacteria sampling for Divide Creek (ID17040215SK014_02) was collected downstream in what the Integrated Report calls Warm Creek AU (ID17040215SK013_03) where there was water.

Notes: Total maximum daily load (TMDL), *Escherichia coli (E. coli*), potential natural vegetation (PNV), assessment unit (AU).

Table 18. Water bodies and pollutants for which new TMDLs were developed or revised.

Water Body	Assessment Unit Number	Pollutant(s)
Medicine Lodge Creek	ID17040215SK002_04	Temperature
Indian Creek	ID17040215SK003_02	Temperature
	ID17040215SK003_03	Temperature
West Fork Indian Creek	ID17040215SK005_02	*Escherichia coli* (*E. coli*)
Middle Creek	ID17040215SK007_02	Temperature
	ID17040215SK007_03	*E. coli;* temperature
	ID17040215SK008_02	Temperature
Edie Creek	ID17040215SK010_02	Temperature
Medicine Lodge Creek	ID17040215SK011_02	Temperature
	ID17040215SK011_03	Temperature
	ID17040215SK011_04	Temperature
Irving Creek	ID17040215SK012_02	Temperature
	ID17040215SK012_03	Temperature
Warm Creek	ID17040215SK013_02	Temperature
	ID17040215SK013_03	Temperature
Divide Creek	ID17040215SK014_02	*E. coli*
Horse Creek	ID17040215SK015_02	Temperature
Fritz Creek	ID17040215SK016_02	Temperature
Webber Creek	ID17040215SK017_02	Temperature
Deep Creek	ID17040215SK018_02	Temperature
	ID17040215SK018_03	Temperature
Crooked Creek	ID17040215SK021_02	Temperature
	ID17040215SK021_03	Temperature

Many watershed improvement projects have been completed and are ongoing in the Medicine Lodge Creek subbasin. The Clark SCD has worked with private landowners to implement BMPs to meet the load allocations in the 2003 TMDL.

Progress toward restoring beneficial uses is apparent in that Edie, Irving, and Crooked Creeks originally exceeded bacteria standards but are now meeting recreation criteria. For AUs that are still exhibiting excess bacteria concentrations, DEQ recommends coordinating monitoring with critical low flows and when grazing allotments are most active.

When sediment was added to the 2002 Integrated Report, the listings were based on field audits by BLM that do not meet DEQ’s criteria for assessments. DEQ investigated these AUs for sediment impairment and found no potential source or pathway for excess sediment.

The BLM Upper Snake Field Office continues to monitor water quality and implement watershed improvement projects as documented in their implementation plan (BLM 2006). The Dubois Ranger District of the Caribou-Targhee National Forest manages prescribed grazing in riparian areas to minimize livestock trampling and increase canopy cover.

This document was prepared with input from the public, as described in Appendix F. Following the public comment period, comments and DEQ responses will also be included in this appendix, and a distribution list will be included in Appendix G.

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GIS Coverages

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Glossary

§303(d)

Refers to section 303 subsection "d" of the Clean Water Act. Section 303(d) requires states to develop a list of water bodies that do not meet water quality standards. This section also requires total maximum daily loads (TMDLs) be prepared for listed waters. Both the list and the TMDLs are subject to United States Environmental Protection Agency approval.

Assessment Unit (AU)

A group of similar streams that have similar land use practices, ownership, or land management. However, stream order is the main basis for determining AUs. All the waters of the state are defined using AUs, and because AUs are a subset of water body identification numbers, they tie directly to the water quality standards so that beneficial uses defined in the water quality standards are clearly tied to streams on the landscape.

Beneficial Use

Any of the various uses of water that are recognized in water quality standards, including, but not limited to, aquatic life, recreation, water supply, wildlife habitat, and aesthetics.

Beneficial Use Reconnaissance Program (BURP)

A program for conducting systematic biological and physical habitat surveys of water bodies in Idaho. BURP protocols address lakes, reservoirs, and wadeable streams and rivers.

Exceedance

A violation (according to DEQ policy) of the pollutant levels permitted by water quality criteria.

Fully Supporting

In compliance with water quality standards and within the range of biological reference conditions for all designated and existing beneficial uses as determined through the *Water Body Assessment Guidance* (Grafe et al. 2002).

Load Allocation (LA)

A portion of a water body's load capacity for a given pollutant that is given to a particular nonpoint source (by class, type, or geographic area).

Load(ing)

The quantity of a substance entering a receiving stream, usually expressed in pounds or kilograms per day or tons per year. Load is the product of flow (discharge) and concentration.

Load Capacity (LC)

How much pollutant a water body can receive over a given period without causing violations of state water quality standards. Upon allocation to various sources, a margin of safety, and natural background contributions, it becomes a total maximum daily load.

Margin of Safety (MOS)

An implicit or explicit portion of a water body's load capacity set aside to allow for uncertainly about the relationship between the pollutant loads and the quality of the receiving water body. The margin of safety is a required component of a total maximum daily load (TMDL) and is often incorporated into conservative assumptions used to develop the TMDL (generally within the calculations and/or models). The margin of safety is not allocated to any sources of pollution.

Nonpoint Source

A dispersed source of pollutants generated from a geographical area when pollutants are dissolved or suspended in runoff and then delivered into waters of the state. Nonpoint sources are without a discernable point or origin. They include, but are not limited to, irrigated and nonirrigated lands used for grazing, crop production, and silviculture; rural roads; construction and mining sites; log storage or rafting; and recreation sites.

Not Assessed (NA)

A concept and an assessment category describing water bodies that have been studied but are missing critical information needed to complete an assessment.

Not Fully Supporting

Not in compliance with water quality standards or not within the range of biological reference conditions for any beneficial use as determined through the *Water Body Assessment Guidance* (Grafe et al. 2002).

Point Source

A source of pollutants characterized by having a discrete conveyance, such as a pipe, ditch, or other identifiable "point" of discharge into a receiving water. Common point sources of pollution are industrial and municipal wastewater plants.

Pollutant

Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.

Pollution

A very broad concept that encompasses human-caused changes in the environment that alter the functioning of natural processes and produce undesirable environmental and health effects. Pollution includes human-induced alteration of the physical, biological, chemical, and radiological integrity of water and other media.

Stream Order

Hierarchical ordering of streams based on the degree of branching. A 1st-order stream is an unforked or unbranched stream. Under Strahler's (1957) system, higher-order streams result from the joining of two streams of the same order.

Total Maximum Daily Load (TMDL)

A TMDL is a water body's load capacity after it has been allocated among pollutant sources. It can be expressed on a time basis other than daily if appropriate. Sediment loads, for example, are often calculated on an annual basis. A TMDL is equal to the load capacity, such that load capacity = margin of safety + natural background + load allocation + wasteload allocation = TMDL. In common usage, a TMDL also refers to the written document that contains the statement of loads and supporting analyses, often incorporating TMDLs for several water bodies and/or pollutants within a given watershed.

Wasteload Allocation (WLA)

The portion of receiving water's load capacity that is allocated to one of its existing or future point sources of pollution. Wasteload allocations specify how much pollutant each point source may release to a water body.

Water Body

A stream, river, lake, estuary, coastline, or other water feature, or portion thereof.

Water Quality Criteria

Levels of water quality expected to render a body of water suitable for its designated uses. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, aquatic habitat, or industrial processes.

Water Quality Standards

State-adopted and United States Environmental Protection Agency-approved ambient standards for water bodies. The standards prescribe the use of the water body and establish the water quality criteria that must be met to protect designated uses.

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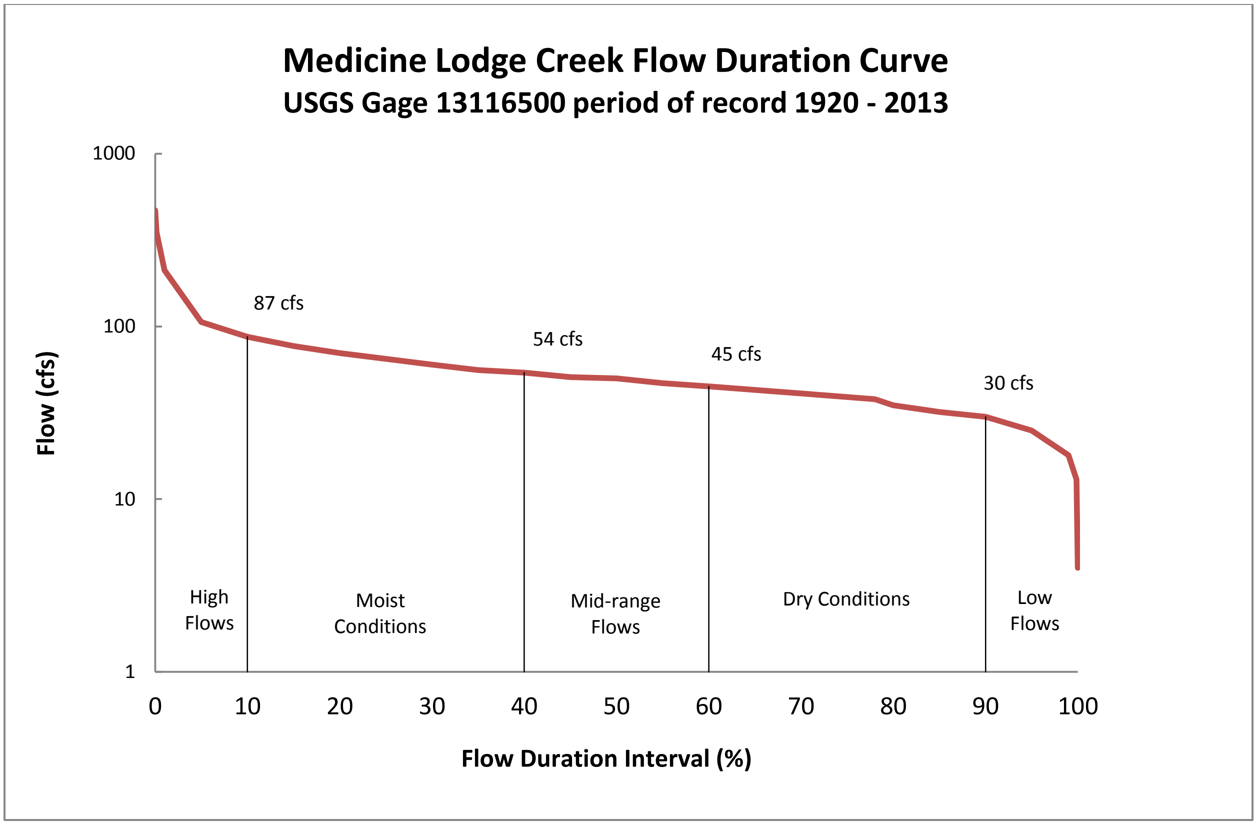
Appendix A. Flow and Load Duration Curves

For US Geological Survey (USGS) 13116500, Medicine Lodge Creek nr Small, ID, the period of record is April 1921 to December 1923, October 1941 to January 1949, and May 1985 to current. This station is located at latitude 44.269167, longitude -112.410283 in Clark County, Idaho. From the daily streamflow data, Idaho Department of Environmental Quality (DEQ) developed the following flow duration statistics:

FLOW DURATION SUMMARY			Station ID:	13116500					
	Peak to Low		Station name:	Medicine Lodge Creek nr Small, ID					
	cfs	cfs/sm	1-Day Peak	High	Moist	Mid	Dry	Low	
0.007	470	1.801	324	106	65	50	38	25	cfs
0.135	353	1.351	1.172	0.384	0.235	0.181	0.138	0.090	mm/day
0.274	324	1.241	1.241	0.406	0.249	0.192	0.146	0.096	cfs/sq.mi.
1.000	211	0.810							
5.000	106	0.406							
10.000	87	0.333	Annual	cfs/sq.mi.	C.V				
15.000	77	0.295	Average	0.218	0.627	36.9%	3.0	inches/yr	
20.000	70	0.268		mm/day					
25.000	65	0.249		0.21					
30.000	60	0.230							
35.000	56	0.215		Summary Statistics					
40.000	54	0.207		57	0.218	Average			
45.000	51	0.195		36	0.137	Standard Deviation			
50.000	50	0.192		0.627	0.627	Coefficient of Variation			
55.000	47	0.180							
60.000	45	0.172							
65.000	43	0.165							
70.000	41	0.157							
78.000	38	0.146							
80.000	35	0.134							
85.000	32	0.123							
90.000	30	0.115							
95.000	25	0.096							
99.000	18	0.069							
99.865	13	0.050							
100.000	4.0	0.015							

These flow duration intervals can be plotted and graphed as follows:



From this flow duration analysis, the flow ranges in each of the five hydrological categories equals the following:

	Cubic feet per second
• High flows 0 to 10%	87–470
• Moist conditions 10% to 40%	54–86
• Midrange flows 40% to 60%	45–53
• Dry conditions 60% to 90%	30–44
• Low flows 90% to 100%	4 through 24

This method of defining flow intervals places the midpoints of the moist, midrange, and dry zones at the 25th, 50th, and 75th percentiles, respectively. These percentiles for Medicine Lodge Creek equal the following:

- 25th—38 cfs
- 50th—50 cfs
- 75th—65 cfs

In addition to providing continuous daily raw data, the USGS website also provides statistics, such as the mean value of all of the daily mean streamflow values shown in the table below. This table shows the average streamflow that can be expected for all of the days of the year. DEQ added the color-coding to classify each streamflow value according to its flow interval category.

00060, Discharge, cubic feet per second,												
Day of	Mean of daily mean values for each day for 38 - 40 years of record in, ft3/s (Calculation Period 1920-10-01 -> 2013-09-30)											
month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	39	41	46	55	58	99	85	63	51	47	48	44
2	39	40	46	55	59	100	85	63	51	48	48	43
3	38	41	47	55	60	103	84	63	50	49	48	42
4	37	42	47	56	62	102	83	63	50	49	47	41
5	37	43	47	57	63	102	82	63	50	49	48	41
6	37	43	47	56	64	105	82	62	50	49	48	42
7	37	43	47	55	67	106	80	61	50	49	47	41
8	38	43	48	56	67	106	79	61	50	49	48	40
9	38	43	48	55	67	108	78	60	50	49	47	38
10	39	42	48	53	68	105	78	60	50	49	46	39
11	39	41	49	53	69	103	79	59	49	50	46	38
12	38	42	49	54	70	102	77	58	49	49	47	39
13	37	42	49	54	71	103	74	58	49	49	47	40
14	38	42	50	55	72	103	74	57	48	50	47	41
15	38	43	51	55	74	103	74	56	48	50	47	40
16	38	44	52	54	78	103	73	56	48	50	47	40
17	37	45	55	54	84	105	72	56	49	50	48	38
18	38	45	53	55	86	103	72	55	49	49	47	38
19	38	45	53	55	89	101	72	55	48	49	48	38
20	38	45	53	56	91	98	72	55	49	50	47	39
21	38	45	54	56	95	98	71	56	48	49	46	39
22	39	45	54	58	96	96	70	55	48	50	45	39
23	39	45	53	59	97	95	69	54	48	49	44	39
24	39	46	52	58	98	94	68	55	48	49	45	39
25	40	46	53	57	99	93	69	53	47	49	45	40
26	39	44	54	57	101	93	68	53	48	49	45	40
27	39	44	54	56	102	92	66	53	47	49	43	40
28	38	44	53	57	101	89	65	52	47	49	43	41
29	39	49	53	58	100	88	66	51	47	49	43	39
30	39		53	58	101	86	64	51	47	49	44	39
31	40		54		99		64	51		48		39

DEQ has categorized each of these daily mean values into its flow season, along with the flow range and season to be expected in Medicine Lodge Creek.

	cfs	season
High Flows 0 to 10%	87-470	High flows are from May 18 through June 30
Moist Conditions 10 to 40%	54-86	Moist Conditions are from April 1 through May 17 and from July 1 through August 24
Mid-range flows 40 to 60%	45-53	Mid-range flows are from February 17 through March 30 and August 25 through November 26
Dry conditions 60 to 90%	30-44	Dry conditions are from November 27 through February 16
Low Flows 90 to 100%	4 through 29	Low Flows do not occur on average

This type of descriptive hydrological analysis is valuable in allocating necessary load reductions when a total maximum daily load (TMDL) is required for a water body.

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Appendix B. State and Site-Specific Water Quality Standards and Criteria

Water Quality Standards Applicable to Salmonid Spawning Temperature

Water quality standards for temperature are specific numeric values not to be exceeded during the salmonid spawning and egg incubation period, which varies by species. For spring-spawning salmonids, the default spawning and incubation period recognized by the Idaho Department of Environmental Quality (DEQ) is generally March 15 to July 15 (Grafe et al. 2002). Fall spawning can occur as early as September 1 and continue with incubation into the following spring up to June 1. As per IDAPA 58.01.02.250.02.f.ii., the following water quality criteria need to be met during that time period:

- 13 °C as a daily maximum water temperature
- 9 °C as a daily average water temperature

For the purposes of a temperature total maximum daily load (TMDL), the highest recorded water temperature in a recorded data set (excluding any high water temperatures that may occur on days when air temperatures exceed the 90th percentile of the highest annual maximum weekly maximum air temperatures) is compared to the daily maximum criterion of 13 °C. The difference between the two water temperatures represents the temperature reduction necessary to achieve compliance with temperature standards.

Natural Background Provisions

For potential natural vegetation temperature TMDLs, it is assumed that natural temperatures may exceed these criteria during certain time periods. If potential natural vegetation targets are achieved yet stream temperatures are warmer than these criteria, it is assumed that the stream's temperature is natural (provided there are no point sources or human-induced ground water sources of heat) and natural background provisions of Idaho water quality standards apply:

> When natural background conditions exceed any applicable water quality criteria set forth in Sections 210, 250, 251, 252, or 253, the applicable water quality criteria shall not apply; instead, there shall be no lowering of water quality from natural background conditions. Provided, however, that temperature may be increased above natural background conditions when allowed under Section 401. (IDAPA 58.01.02.200.09)

Section 401 relates to point source wastewater treatment requirements. In this case, if temperature criteria for any aquatic life use are exceeded due to natural conditions, then a point source discharge cannot raise the water temperature by more than 0.3 °C (IDAPA 58.01.02.401.01.c).

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Appendix C. Exceedances of Salmonid Spawning Criteria, 1997–2000 (DEQ 2003)

Table 10. 2000 DEQ Temperature data and number of days where water temperatures exceeded the Salmonid Spawning Criteria during the entire monitoring period.

		Salmonid Spawning inst. 13? C			Salmonid Spawning daily average 9? C		
Stream Name	WBID No.	Days	Max. # ?C Over	Max Date	Days	Max. # ?C Over	Max Date
Crooked Creek	21	63	3.1	29-Jul	88	3.91	2-Aug
Deep Creek	18	103	12.3	5-Aug	101	9.43	2-Aug
Edie Creek, mouth	10	80	4.1	13-Jul	94	5.27	2-Aug
Edie Creek, at BLM boundary	10	89	5.1	1-Aug	94	4.51	1-Aug
Fritz Creek, mouth	16	97	5	13-Jul & 21-Jul	107	5.39	31-Jul
Fritz Creek, at forks	16	76	5.6	26-Jul	88	5.04	27-Jul
Horse Creek	15	104	6.7	23-Jun	113	6.17	13-Jul
Indian Creek	5	83	6.1	15-Jul	91	5.02	30-Jul
Irving Creek, mouth	12	82	6.1	30-Jun	98	4.99	24-Jun
Irving Creek, BLM boundary	12	95	7.4	9-Aug	92	4.98	5-Aug

		Salmonid Spawning inst. 13? C			Salmonid Spawning daily average 9? C		
Steam Name	WBID No.	Days	Max. # °C over	Max Date	Days	Max # °C Over	Max Date
Irving Creek, E. Fork	12	7	0.4	23-Jun, 24-Jun, & 30-Jun	35	0.68	1-Jul
Medicine Lodge Creek, at Small, ID	2	94	7.5	31-Jul	104	9.72	31-Jul
Medicine Lodge Creek, at Middle Cr.	6	92	6.8	2-Aug	103	8.62	31-Jul
Medicine Lodge Creek, below Spring Hollow	6	95	7.2	13-Jul & 22-Jul	101	7.61	2-Aug
Middle Creek, mouth	7	93	6.9	2-Aug	103	6.3	2-Aug
Middle Creek	7	102	8	1-Aug	106	7.7	2-Aug
Warm Creek	13	124	8	1-Aug	124	9.1	1-Aug
Warm Springs Creek	20	124	15.9	23-Aug	124	18.7	31-Jul
Webber Creek, mouth	17	89	5.6	13-Jul	97	5.2	2-Aug
Webber Creek, past USFS boundary	17	48	2.58	14-Jul	65	2.36	26-Jul
Webber Creek, past USFS boundary	17	44	2.43	14-Jul	61	2.09	26-Jul

Table 11. 1997-1998 BLM data, and Exceedances of the Salmonid Spawning Criteria

			Salmonid Spawning inst. 13 °C			Salmonid Spawning daily average 9 °C		
Stream Name	Description	WBID No.	Days	Max # °C Over	Max Date	Days	Max # °C Over	Max Date
Indian Creek	W. Fork, at USFS boundary	5	82	4.1	16-Jul, 21-Jul, 3-Aug	88	2.9	16-Jul
Edie Creek	3 mi. above MLC confluence	10	45	1.8	7-Jun, 15-Jul, 16-Jul	14	0.3	24-Jul
Irving Creek	3/4 mi. above MLC confluence	12	45	2.2	21-Jul	69	1.7	24-Jul
Warm Creek	At USFS boundary	13	137	7.7	21-Jul, 24-Jul	137	9.9	24-Jul
Horse Creek		15	97	2.8	19-Jun	128	3.8	24-Jul
Horse Creek	Lower	15	82	6.8	19-Jul	89	5.6	18-Jul
Horse Creek	Upper	15	0			80	1.4	18-Jul

Table 12. 2000 USFS data and Exceedances of the Salmonid Spawning Criteria

		Salmonid Spawning inst. 13° C			Salmonid Spawning daily average 9° C		
Stream Name	WBID No.	Days	Max # °C Over	Max Date	Days	Max # °C Over	Max Date
Medicine Lodge Creek	6	69	6.11	2-Aug	75	7.26	2-Aug
Fritz Creek	16	72	7.97	26-Jul, 9-Aug	68	5.16	26-Jul

Table. 25 Estimated Current Load for Temperature in the Medicine Lodge Subbasin

Stream Name	Maximum Number of Days Exceedances[a]	Highest Instantaneous Value (°C)	Highest Average Daily Value (°C)
Crooked Creek	30	19.00	12.02
Deep Creek	39	25.3	18.4
East Fork Irving Creek	18	13.39	9.68
Edie Creek (at BLM Boundary)	30	17.79	12.84
Edie Creek (at mouth)	30	16.78	13.55
Fritz Creek (at mouth)	30	20.65	14.23
Fritz Creek (below forks)	29	18.02	13.73
Horse Creek	38	18.13	14.96
Indian Creek	30	18.60	13.46
Irving Creek (at mouth)	30	19.13	13.99
Medicine Lodge Creek (above Middle Creek)	30	19.01	16.48
Medicine Lodge Creek (at Small, ID)	30	19.55	17.47
Medicine Lodge Creek (at Spring Hollow)	30	20.21	15.86
Middle Creek (mouth)	30	18.91	15.70
Warm Creek	30	20.84	17.80
Webber Creek (at mouth)	31	18.60	13.80
Webber Creek (at trailhead)	24	15.58	11.26

[a] Exceedances are considered any day exceeding 13° C instantaneous value or 9° C average daily value or 22 °C (71.6 ° F) and the maximum daily average temperature below 19 °C (66.2 °F) for streams exceeding CWAL criteria.

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Appendix D. Streambank Erosion Inventory Calculation and McNeil Core Sampling Results

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STREAMBANK EROSION INVENTORY CALCULATION WORKSHEET

Stream:	Horse Creek	**Stream Segment Location (DD)**	
Assessment Unit:	ID 17040215SK015_02	***Upstream N***	44 25 58.9
Segment Inventoried:	Lower reach	***W***	-112 40 51.1
Total Reach:		***Downstream N***	44 25 48.8
Date Collected:	20-Jun-11	***W***	-112 40 30.5
Field Crew:	A. Swift; T. Housley	**Notes:**	Adjacent land use BLM grazing and recreation; road parallel for short distance, then cattle trail; mostly vegetated and stable.
Data Reduced By:	D. Sharp		

Current Load Streambank Erosion Calculations		Unit	Area Applied
Right, left or both bank measurements	2	Both Banks	Inventoried Segment
Inventory/Thalweg Length (LBB) (stream flowpath distance)	1082.00	ft	Inventoried Segment
TMDL Margin of Safety	10	%	Total Reach
Bulk Density (BD)	85	lb/ft^3	Total Reach
Length of Similar Stream	18000	ft	Total Reach
Estimated Distance inventoried	2164.00	ft	"
Total Erosive Bank Length	156.00	ft	"
Percent Erosive Bank	7.2	%	"
Eroding Area (AE)	197.10	ft^2	"
Lateral Recession Rate (RLR)	0.04		"
Bank Erosion (E)	0.34	tons/year	"
Total Bank Erosion Rate (ER)	1.64	tons/mile/year	Reach and Segment
Total Bank Erosion	5.57	tons/year	"

Recession Rate Calculations

Factor	Field Stability Score	Erosion Severity Reduction
Bank Erosion Evidence (0 to 3)	1	1
Bank Stability Condition (0 to 3)	0	0
Bank Cover/Vegetation(0 to 3)	1	1
Lateral Channel Stability (0 to 3)	0	0
Channel Bottom Stability (0 to 2)	1	1
In-Channel Deposition (-1 to 1)	0	0
Total = Slight (0-4); Moderate (4-8); Severe (>8)	3	3
Lateral Recession Rate (RLR) (ft/yr)	**0.04**	**0.04**

Load Capacity Streambank Erosion Calculations for Total Reach		Unit	Area Applied
Eroding Area at Load Capacity (AE)	546.83	ft^2	Inventoried Segment
Bank Erosion at Load Capacity (E)	0.93	tons/year	"
Total Bank Erosion Rate at Load Capacity (ER)	4.54	tons/mile/year	Reach and Segment
Total Bank Erosion at Load Capacity for Reach	15.46	tons/year	Total Reach

Summary of Loads

Current Load		Load Capacity			
Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Load Reduction Required?	Margin of Safety (tons/yr)
1.6	**5.6**	**4.5**	**15.5**	**No**	**0**

Percent Erosion Reduction (%)	**-177**
Total Erosion Reduction (tons/yr)	**-10**

AU ID17040215SK015_02 Inventory location

Isolated example of aquatic algae at the location of the worst cut bank.

STREAMBANK EROSION INVENTORY CALCULATION WORKSHEET

Stream:	Divide Creek	**Stream Segment Location (DD)**	
Assessment Unit:	ID 17040215SK014_02	***Upstream N***	43.986340
Segment Inventoried:		***W***	-113.75707
Total Reach:		***Downstream N***	43.982990
Date Collected:	20-Jun-11	***W***	-113.75166
Field Crew:	A. Swift; T. Housley	**Notes:**	Adjacent land use BLM grazing and recreation; stable, few cut banks; not perennial enough for riparian vegetation; runs dry after spring runoff
Data Reduced By:	D. Sharp		

Current Load Streambank Erosion Calculations		**Unit**	**Area Applied**
Right, left or both bank measurements	1	Single Bank	Inventoried Segment
Inventory/Thalweg Length (LBB) (stream flowpath distance)	2844.00	ft	Inventoried Segment
TMDL Margin of Safety	10	%	Total Reach
Bulk Density (BD)	85	lb/ft^3	Total Reach
Length of Similar Stream	28248	ft	Total Reach
Estimated Distance inventoried	2844.00	ft	"
Total Erosive Bank Length	36.20	ft	"
Percent Erosive Bank	1.3	%	"
Eroding Area (AE)	26.78	ft^2	"
Lateral Recession Rate (RLR)	0.04		"
Bank Erosion (E)	0.05	tons/year	"
Total Bank Erosion Rate (ER)	0.08	tons/mile/year	Reach and Segment
Total Bank Erosion	0.45	tons/year	"

Recession Rate Calculations		
Factor	**Field Stability Score**	**Erosion Severity Reduction**
Bank Erosion Evidence (0 to 3)	1	1
Bank Stability Condition (0 to 3)	1	1
Bank Cover/Vegetation(0 to 3)	1	1
Lateral Channel Stability (0 to 3)	0	0
Channel Bottom Stability (0 to 2)	0	0
In-Channel Deposition (-1 to 1)	0	0
Total = Slight (0-4); Moderate (4-8); Severe (>8)	3	3
Lateral Recession Rate (RLR) (ft/yr)	**0.04**	**0.04**

Load Capacity Streambank Erosion Calculations for Total Reach		**Unit**	**Area Applied**
Eroding Area at Load Capacity (AE)	420.79	ft^2	Inventoried Segment
Bank Erosion at Load Capacity (E)	0.72	tons/year	"
Total Bank Erosion Rate at Load Capacity (ER)	1.33	tons/mile/year	Reach and Segment
Total Bank Erosion at Load Capacity for Reach	7.11	tons/year	Total Reach

Summary of Loads					
Current Load		**Load Capacity**			
Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Load Reduction Required?	Margin of Safety (tons/yr)
0.1	**0.5**	**1.3**	**7.1**	**No**	**0**

Percent Erosion Reduction (%)	**-1471**
Total Erosion Reduction (tons/yr)	**-7**

AU ID17040215SK014_02 Inventory location

High flow season 6/20/2011

STREAMBANK EROSION INVENTORY CALCULATION WORKSHEET

Stream:	Middle Creek	**Stream Segment Location (DD)**	
Assessment Unit:	ID 17040215SK008_02	***Upstream N***	44.399580
Segment Inventoried:	Mid-reach	***W***	-112.503986
Total Reach:		***Downstream N***	44.397765
Date Collected:	20-Jun-11	***W***	-112.50469
Field Crew:	A. Swift; T. Housley	**Notes:**	Cutbanks at start of SEI on upslope side from natural entrenchment; Even where constrained by the road, cuts are well-vegetated except one 2-meter reach.
Data Reduced By:	D. Sharp		

Current Load Streambank Erosion Calculations		**Unit**	**Area Applied**
Right, left or both bank measurements	1	Single Bank	Inventoried Segment
Inventory/Thalweg Length (LBB) (stream flowpath distance)	2340.00	ft	Inventoried Segment
TMDL Margin of Safety	10	%	Total Reach
Bulk Density (BD)	85	lb/ft^3	Total Reach
Length of Similar Stream	14731	ft	Total Reach
Estimated Distance inventoried	2340.00	ft	"
Total Erosive Bank Length	8.50	ft	"
Percent Erosive Bank	0.4	%	"
Eroding Area (AE)	12.38	ft^2	"
Lateral Recession Rate (RLR)	0.03		"
Bank Erosion (E)	0.02	tons/year	"
Total Bank Erosion Rate (ER)	0.04	tons/mile/year	Reach and Segment
Total Bank Erosion	0.10	tons/year	"

Recession Rate Calculations		
Factor	**Field Stability Score**	**Erosion Severity Reduction**
Bank Erosion Evidence (0 to 3)	0.5	1
Bank Stability Condition (0 to 3)	0	1
Bank Cover/Vegetation(0 to 3)	0	1
Lateral Channel Stability (0 to 3)	0	0
Channel Bottom Stability (0 to 2)	0.5	0
In-Channel Deposition (-1 to 1)	1	0
Total = Slight (0-4); Moderate (4-8); Severe (>8)	2	3
Lateral Recession Rate (RLR) (ft/yr)	**0.03**	**0.04**

Load Capacity Streambank Erosion Calculations for Total Reach		**Unit**	**Area Applied**
Eroding Area at Load Capacity (AE)	681.63	ft^2	Inventoried Segment
Bank Erosion at Load Capacity (E)	1.16	tons/year	"
Total Bank Erosion Rate at Load Capacity (ER)	2.61	tons/mile/year	Reach and Segment
Total Bank Erosion at Load Capacity for Reach	7.29	tons/year	Total Reach

Summary of Loads					
Current Load		**Load Capacity**			
Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Load Reduction Required?	Margin of Safety (tons/yr)
0.0	**0.1**	**2.6**	**7.3**	**No**	**0**

Percent Erosion Reduction (%)	**-7241**
Total Erosion Reduction (tons/yr)	**-7**

AU ID17040215SK008_02 Inventory location

Upper Middle Creek at the location of the SEI reach.

STREAMBANK EROSION INVENTORY CALCULATION WORKSHEET

Stream:	Warm Creek	**Stream Segment Location (DD)**	
Assessment Unit:	ID 17040215SK013_02	***Upstream N***	44.470099
Segment Inventoried:	Lower Reach	***W***	-112.705027
Total Reach:		***Downstream N***	44.467286
Date Collected:	20-Jun-11	***W***	-112.702647
Field Crew:	A. Swift; T. Housley; D. Sharp	**Notes:**	Very small, annual stream, very stable
Data Reduced By:	D. Sharp		

Current Load Streambank Erosion Calculations		Unit	Area Applied
Right, left or both bank measurements	1	Single Bank	Inventoried Segment
Inventory/Thalweg Length (LBB) (stream flowpath distance)	2298.00	ft	Inventoried Segment
TMDL Margin of Safety	10	%	Total Reach
Bulk Density (BD)	85	lb/ft^3	Total Reach
Length of Similar Stream	8765	ft	Total Reach
Estimated Distance inventoried	2298.00	ft	"
Total Erosive Bank Length	1.00	ft	"
Percent Erosive Bank	0.0	%	"
Eroding Area (AE)	2.00	ft^2	"
Lateral Recession Rate (RLR)	0.01		"
Bank Erosion (E)	0.00	tons/year	"
Total Bank Erosion Rate (ER)	0.00	tons/mile/year	Reach and Segment
Total Bank Erosion	0.00	tons/year	"

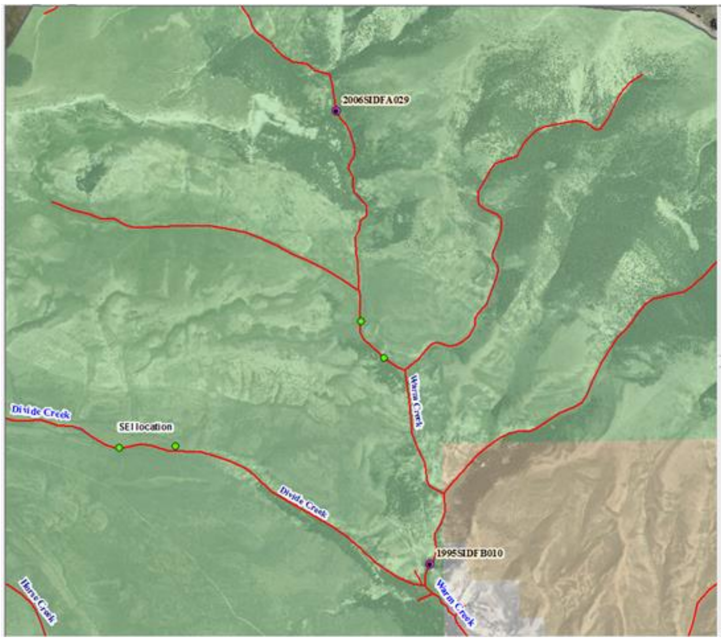
Recession Rate Calculations		
Factor	**Field Stability Score**	**Erosion Severity Reduction**
Bank Erosion Evidence (0 to 3)	0	1
Bank Stability Condition (0 to 3)	0	1
Bank Cover/Vegetation(0 to 3)	0	1
Lateral Channel Stability (0 to 3)	0	0
Channel Bottom Stability (0 to 2)	0	0
In-Channel Deposition (-1 to 1)	0	0
Total = Slight (0-4); Moderate (4-8); Severe (>8)	0	3
Lateral Recession Rate (RLR) (ft/yr)	**0.01**	**0.04**

Load Capacity Streambank Erosion Calculations for Total Reach		Unit	Area Applied
Eroding Area at Load Capacity (AE)	919.20	ft^2	Inventoried Segment
Bank Erosion at Load Capacity (E)	1.56	tons/year	"
Total Bank Erosion Rate at Load Capacity (ER)	3.59	tons/mile/year	Reach and Segment
Total Bank Erosion at Load Capacity for Reach	5.96	tons/year	Total Reach

Summary of Loads					
Current Load		**Load Capacity**			
Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Load Reduction Required?	Margin of Safety (tons/yr)
0.0	**0.0**	**3.6**	**6.0**	**No**	**0**

Percent Erosion Reduction (%)	**-183740**
Total Erosion Reduction (tons/yr)	**-6**

AU ID17040215SK013_02 Inventory location



6/20/2011 SEI. Very small, annual stream, very stable

STREAMBANK EROSION INVENTORY CALCULATION WORKSHEET

Stream:	Dry Creek	**Stream Segment Location (DD)**	
Assessment Unit:	ID 17040215SK009_02	***Upstream N***	44 23 42.0
Segment Inventoried:	1st-order is the only reach in the AU	***W***	-112 30 42.5
Total Reach:		***Downstream N***	44 23 48.8
Date Collected:	20-Jun-11	***W***	-112 38 50.9
Field Crew:	A. Swift; T. Housley; D. Sharp	**Notes:**	Very small, annual stream, very stable
Data Reduced By:	D. Sharp		

Current Load Streambank Erosion Calculations		Unit	Area Applied
Right, left or both bank measurements	1	Single Bank	Inventoried Segment
Inventory/Thalweg Length (LBB) (stream flowpath distance)	2160.00	ft	Inventoried Segment
TMDL Margin of Safety	10	%	Total Reach
Bulk Density (BD)	85	lb/ft^3	Total Reach
Length of Similar Stream	27476	ft	Total Reach
Estimated Distance inventoried	2160.00	ft	"
Total Erosive Bank Length	66.60	ft	"
Percent Erosive Bank	3.1	%	"
Eroding Area (AE)	147.30	ft^2	"
Lateral Recession Rate (RLR)	0.03		"
Bank Erosion (E)	0.19	tons/year	"
Total Bank Erosion Rate (ER)	0.46	tons/mile/year	Reach and Segment
Total Bank Erosion	2.39	tons/year	"

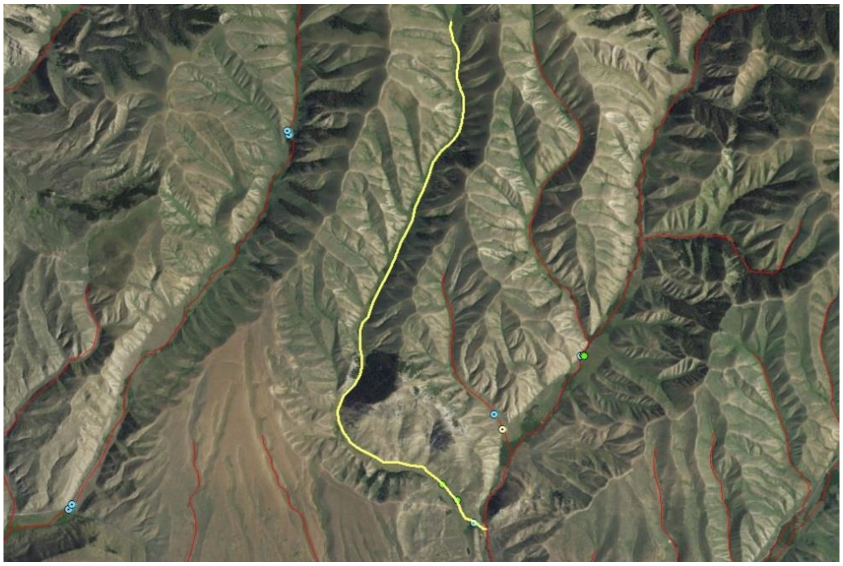
Recession Rate Calculations		
Factor	**Field Stability Score**	**Erosion Severity Reduction**
Bank Erosion Evidence (0 to 3)	0.5	1
Bank Stability Condition (0 to 3)	0	1
Bank Cover/Vegetation(0 to 3)	0.5	1
Lateral Channel Stability (0 to 3)	0	0
Channel Bottom Stability (0 to 2)	0	0
In-Channel Deposition (-1 to 1)	1	0
Total = Slight (0-4); Moderate (4-8); Severe (>8)	2	3
Lateral Recession Rate (RLR) (ft/yr)	**0.03**	**0.04**

Load Capacity Streambank Erosion Calculations for Total Reach		Unit	Area Applied
Eroding Area at Load Capacity (AE)	955.46	ft^2	Inventoried Segment
Bank Erosion at Load Capacity (E)	1.62	tons/year	"
Total Bank Erosion Rate at Load Capacity (ER)	3.97	tons/mile/year	Reach and Segment
Total Bank Erosion at Load Capacity for Reach	20.66	tons/year	Total Reach

Summary of Loads					
Current Load		**Load Capacity**			
Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Load Reduction Required?	Margin of Safety (tons/yr)
0.5	**2.4**	**4.0**	**20.7**	**No**	**0**

Percent Erosion Reduction (%)	**-765**
Total Erosion Reduction (tons/yr)	**-18**

AU ID17040215SK009_02 Inventory location



6/21/2011 SEI

STREAMBANK EROSION INVENTORY CALCULATION WORKSHEET

Stream:	Myers Creek	**Stream Segment Location (DD)**	
Assessment Unit:	ID 17040215SK021_02	***Upstream N***	44 23 42.0
Segment Inventoried:	1st-order is the only reach in the AU	***W***	-112 30 42.5
Total Reach:		***Downstream N***	44 23 48.8
Date Collected:	20-Jun-11	***W***	-112 38 50.9
Field Crew:	A. Swift; T. Housley; D. Sharp	**Notes:**	Very small, annual stream, very stable
Data Reduced By:	D. Sharp		

Current Load Streambank Erosion Calculations		Unit	Area Applied
Right, left or both bank measurements	1	Single Bank	Inventoried Segment
Inventory/Thalweg Length (LBB) (stream flowpath distance)	1563.00	ft	Inventoried Segment
TMDL Margin of Safety	10	%	Total Reach
Bulk Density (BD)	85	lb/ft^3	Total Reach
Length of Similar Stream	4502	ft	Total Reach
Estimated Distance inventoried	1563.00	ft	"
Total Erosive Bank Length	200.00	ft	"
Percent Erosive Bank	12.8	%	"
Eroding Area (AE)	910.40	ft^2	"
Lateral Recession Rate (RLR)	0.04		"
Bank Erosion (E)	1.55	tons/year	"
Total Bank Erosion Rate (ER)	5.23	tons/mile/year	Reach and Segment
Total Bank Erosion	4.46	tons/year	"

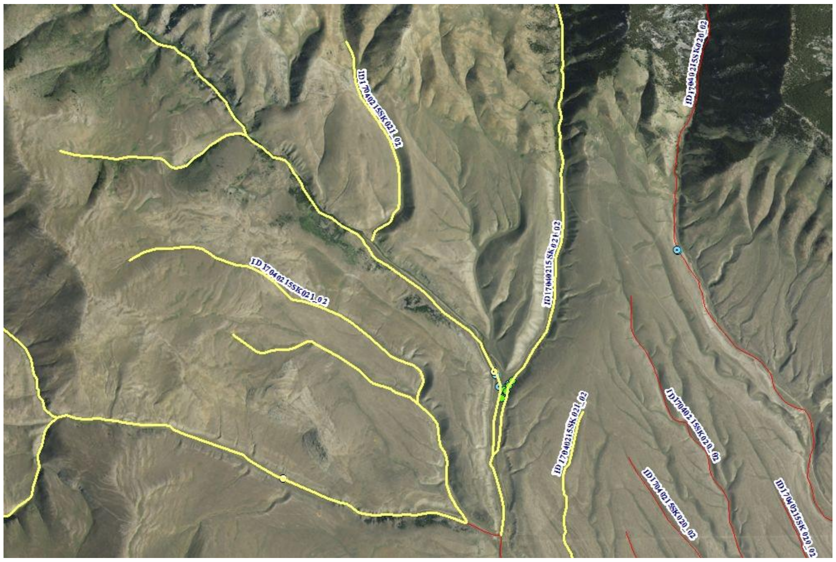
Recession Rate Calculations		
Factor	**Field Stability Score**	**Erosion Severity Reduction**
Bank Erosion Evidence (0 to 3)	1	1
Bank Stability Condition (0 to 3)	0	1
Bank Cover/Vegetation(0 to 3)	1	1
Lateral Channel Stability (0 to 3)	0	0
Channel Bottom Stability (0 to 2)	0	0
In-Channel Deposition (-1 to 1)	1	0
Total = Slight (0-4); Moderate (4-8); Severe (>8)	3	3
Lateral Recession Rate (RLR) (ft/yr)	**0.04**	**0.04**

Load Capacity Streambank Erosion Calculations for Total Reach		Unit	Area Applied
Eroding Area at Load Capacity (AE)	1422.96	ft^2	Inventoried Segment
Bank Erosion at Load Capacity (E)	2.42	tons/year	"
Total Bank Erosion Rate at Load Capacity (ER)	8.17	tons/mile/year	Reach and Segment
Total Bank Erosion at Load Capacity for Reach	6.97	tons/year	Total Reach

Summary of Loads					
Current Load		**Load Capacity**			
Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Load Reduction Required?	Margin of Safety (tons/yr)
5.2	**4.5**	**8.2**	**7.0**	**No**	**0**

Percent Erosion Reduction (%)	**-56**
Total Erosion Reduction (tons/yr)	**-3**

AU ID17040215SK021_02 Inventory location



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STREAMBANK EROSION INVENTORY CALCULATION WORKSHEET

Stream:	Edie Creek	**Stream Segment Location (DD)**	
Assessment Unit:	ID17040215SK010_02	***Upstream N***	44.406110
Segment Inventoried:	1500 ft above BLM boundary	***W***	-112.566930
Total Reach:	lower 1st order segment	***Downstream N***	44.400630
Date Collected:	26-Aug-14	***W***	-112.571950
Field Crew:	Curtis Cooper	**Notes:**	cattle grazing, recreation uses
Data Reduced By:	Mark Shumar		

Current Load Streambank Erosion Calculations		Unit	Area Applied
Right, left or both bank measurements	2	Both Banks	Inventoried Segment
Inventory/Thalweg Length (LBB) (stream flowpath distance)	3100.00	ft	Inventoried Segment
TMDL Margin of Safety	10	%	Total Reach
Bulk Density (BD)	105	lb/ft^3	Total Reach
Length of Similar Stream	15059	ft	Total Reach
Estimated Distance inventoried	6200.00	ft	"
Total Erosive Bank Length	1170.00	ft	"
Percent Erosive Bank	18.9	%	"
Eroding Area (AE)	2049.00	ft^2	"
Lateral Recession Rate (RLR)	0.16		"
Bank Erosion (E)	17.21	tons/year	"
Total Bank Erosion Rate (ER)	29.32	tons/mile/year	Reach and Segment
Total Bank Erosion	83.61	tons/year	"

Recession Rate Calculations

Factor	Field Stability Score	Erosion Severity Reduction
Bank Erosion Evidence (0 to 3)	2	1.5
Bank Stability Condition (0 to 3)	2	1.5
Bank Cover/Vegetation(0 to 3)	2	1.5
Lateral Channel Stability (0 to 3)	2	1.5
Channel Bottom Stability (0 to 2)	1	1
In-Channel Deposition (-1 to 1)	0	1
Total = Slight (0-4); Moderate (4-8); Severe (>8)	9	8
Lateral Recession Rate (RLR) (ft/yr)	**0.16**	**0.15**

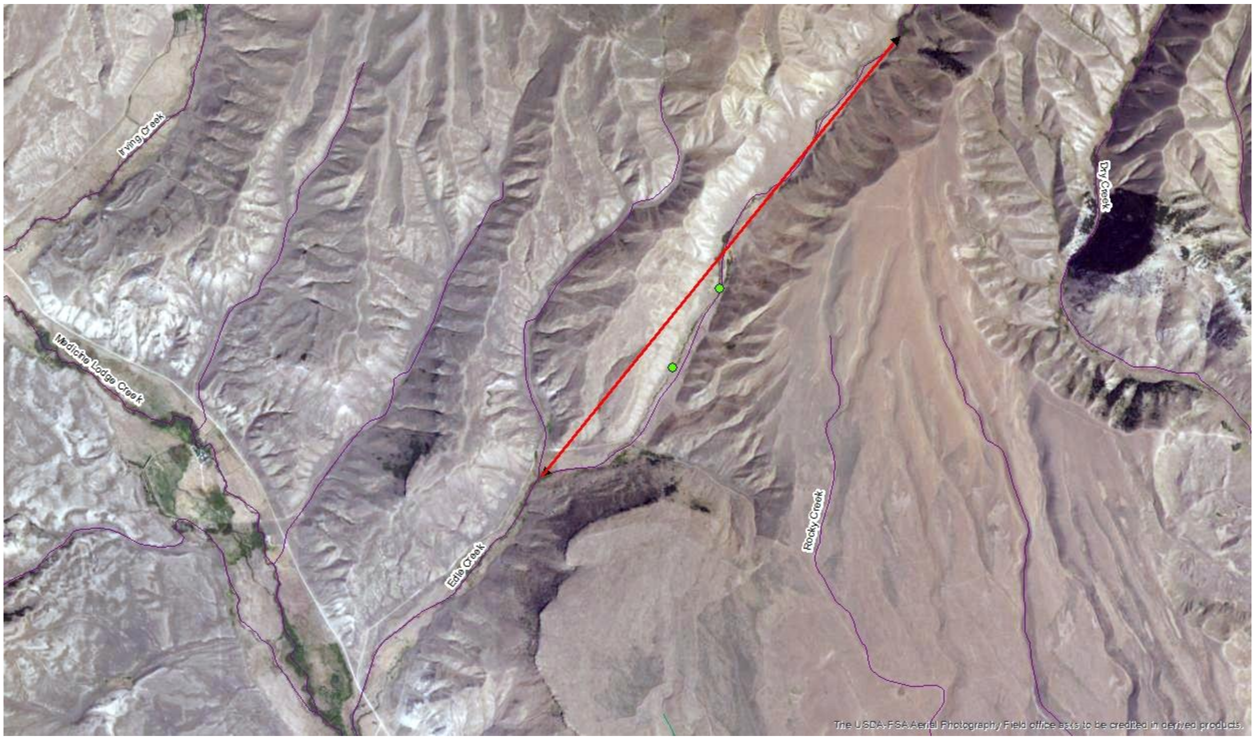
Load Capacity Streambank Erosion Calculations for Total Reach		Unit	Area Applied
Eroding Area at Load Capacity (AE)	2171.59	ft^2	Inventoried Segment
Bank Erosion at Load Capacity (E)	17.10	tons/year	"
Total Bank Erosion Rate at Load Capacity (ER)	29.13	tons/mile/year	Reach and Segment
Total Bank Erosion at Load Capacity for Reach	83.07	tons/year	Total Reach

Summary of Loads

Current Load		Load Capacity			
Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Load Reduction Required?	Margin of Safety (tons/yr)
29.3	**83.6**	**29.1**	**83.1**	**YES**	**8**

Percent Erosion Reduction (%)	**10**
Total Erosion Reduction (tons/yr)	**9**

AU ID17040215SK010_02 inventory location.



STREAMBANK EROSION INVENTORY CALCULATION WORKSHEET

Stream:	Irving Creek	**Stream Segment Location (DD)**	
Assessment Unit:	ID17040215SK012_02	***Upstream N***	44.462070
Segment Inventoried:	Upper - above Bull Pen	***W***	-112.619770
Total Reach:	3640 feet	***Downstream N***	44.455590
Date Collected:	26-Aug-14	***W***	-112.614180
Field Crew:	Curtis Cooper	**Notes:**	grazing, recreation
Data Reduced By:	Mark Shumar		

Current Load Streambank Erosion Calculations		Unit	Area Applied
Right, left or both bank measurements	2	Both Banks	Inventoried Segment
Inventory/Thalweg Length (LBB) (stream flowpath distance)	3640.00	ft	Inventoried Segment
TMDL Margin of Safety	10	%	Total Reach
Bulk Density (BD)	105	lb/ft^3	Total Reach
Length of Similar Stream	14957	ft	Total Reach
Estimated Distance inventoried	7280.00	ft	"
Total Erosive Bank Length	2489.00	ft	"
Percent Erosive Bank	34.2	%	"
Eroding Area (AE)	6595.90	ft^2	"
Lateral Recession Rate (RLR)	0.15		"
Bank Erosion (E)	51.94	tons/year	"
Total Bank Erosion Rate (ER)	75.35	tons/mile/year	Reach and Segment
Total Bank Erosion	213.44	tons/year	"

Recession Rate Calculations		
Factor	**Field Stability Score**	**Erosion Severity Reduction**
Bank Erosion Evidence (0 to 3)	2	1.5
Bank Stability Condition (0 to 3)	1.5	1.5
Bank Cover/Vegetation(0 to 3)	1	1.5
Lateral Channel Stability (0 to 3)	1.5	1.5
Channel Bottom Stability (0 to 2)	1	1
In-Channel Deposition (-1 to 1)	1	1
Total = Slight (0-4); Moderate (4-8); Severe (>8)	8	8
Lateral Recession Rate (RLR) (ft/yr)	**0.15**	**0.15**

Load Capacity Streambank Erosion Calculations for Total Reach		Unit	Area Applied
Eroding Area at Load Capacity (AE)	3858.43	ft^2	Inventoried Segment
Bank Erosion at Load Capacity (E)	30.39	tons/year	"
Total Bank Erosion Rate at Load Capacity (ER)	44.08	tons/mile/year	Reach and Segment
Total Bank Erosion at Load Capacity for Reach	124.85	tons/year	Total Reach

Summary of Loads					
Current Load		**Load Capacity**			
Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Load Reduction Required?	Margin of Safety (tons/yr)
75.3	**213.4**	**44.1**	**124.9**	**YES**	**21**

Percent Erosion Reduction (%)	**47**
Total Erosion Reduction (tons/yr)	**110**

AU ID17040215SK012_02 inventory location.

STREAMBANK EROSION INVENTORY CALCULATION WORKSHEET

Stream:	Irving Creek	**Stream Segment Location (DD)**	
Assessment Unit:	ID17040215SK012_03	***Upstream N***	44.436079
Segment Inventoried:	BLM corner	***W***	-112.617485
Total Reach:	2700 feet	***Downstream N***	44.432253
Date Collected:	26-Aug-14	***W***	-112.619122
Field Crew:	Curtis Cooper	**Notes:**	recreation
Data Reduced By:	Mark Shumar		

Current Load Streambank Erosion Calculations		**Unit**	**Area Applied**
Right, left or both bank measurements	2	Both Banks	Inventoried Segment
Inventory/Thalweg Length (LBB) (stream flowpath distance)	2700.00	ft	Inventoried Segment
TMDL Margin of Safety	10	%	Total Reach
Bulk Density (BD)	105	lb/ft^3	Total Reach
Length of Similar Stream	3937	ft	Total Reach
Estimated Distance inventoried	5400.00	ft	"
Total Erosive Bank Length	274.00	ft	"
Percent Erosive Bank	5.1	%	"
Eroding Area (AE)	1092.00	ft^2	"
Lateral Recession Rate (RLR)	0.06		"
Bank Erosion (E)	3.44	tons/year	"
Total Bank Erosion Rate (ER)	6.73	tons/mile/year	Reach and Segment
Total Bank Erosion	5.02	tons/year	"

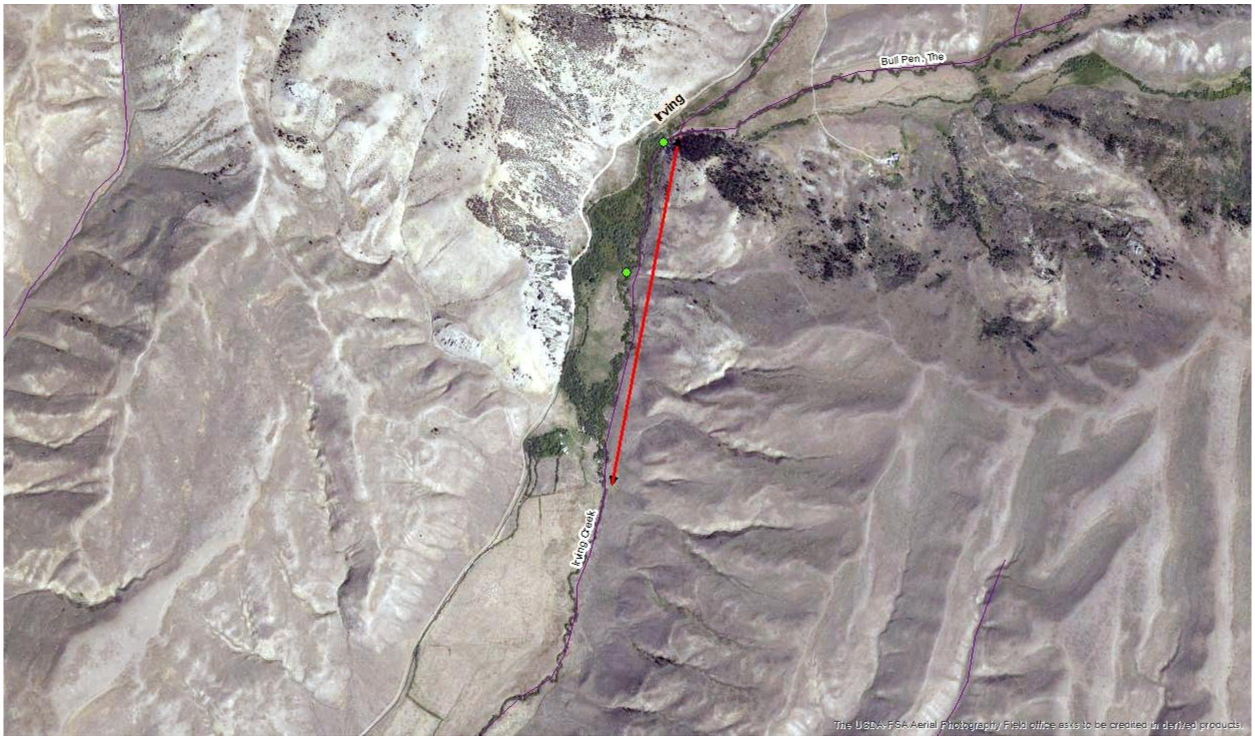
Recession Rate Calculations		
Factor	**Field Stability Score**	**Erosion Severity Reduction**
Bank Erosion Evidence (0 to 3)	1.5	1.5
Bank Stability Condition (0 to 3)	0.5	1.5
Bank Cover/Vegetation(0 to 3)	0.5	1.5
Lateral Channel Stability (0 to 3)	2	1.5
Channel Bottom Stability (0 to 2)	0.5	1
In-Channel Deposition (-1 to 1)	0	1
Total = Slight (0-4); Moderate (4-8); Severe (>8)	5	8
Lateral Recession Rate (RLR) (ft/yr)	**0.06**	**0.15**

Load Capacity Streambank Erosion Calculations for Total Reach		**Unit**	**Area Applied**
Eroding Area at Load Capacity (AE)	4304.23	ft^2	Inventoried Segment
Bank Erosion at Load Capacity (E)	33.90	tons/year	"
Total Bank Erosion Rate at Load Capacity (ER)	66.29	tons/mile/year	Reach and Segment
Total Bank Erosion at Load Capacity for Reach	49.43	tons/year	Total Reach

Summary of Loads					
Current Load		**Load Capacity**			
Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Load Reduction Required?	Margin of Safety (tons/yr)
6.7	**5.0**	**66.3**	**49.4**	**No**	**0**

Percent Erosion Reduction (%)	**0**
Total Erosion Reduction (tons/yr)	**0**

AU ID17040215SK012_03 inventory location.



STREAMBANK EROSION INVENTORY CALCULATION WORKSHEET

Stream:	Medicine Lodge Creek	**Stream Segment Location (DD)**	
Assessment Unit:	ID17040215SK006_04	***Upstream N***	44.315721
Segment Inventoried:	BLM @ Re	***W***	-112.555300
Total Reach:		***Downstream N***	44.314380
Date Collected:	26-Aug-14	***W***	-112.549808
Field Crew:	Curtis Cooper	**Notes:**	basalt/limestone geology; grazing landuse
Data Reduced By:	Mark Shumar		

Current Load Streambank Erosion Calculations		**Unit**	**Area Applied**
Right, left or both bank measurements	2	Both Banks	Inventoried Segment
Inventory/Thalweg Length (LBB) (stream flowpath distance)	3260.00	ft	Inventoried Segment
TMDL Margin of Safety	10	%	Total Reach
Bulk Density (BD)	105	lb/ft^3	Total Reach
Length of Similar Stream	43832	ft	Total Reach
Estimated Distance inventoried	6520.00	ft	"
Total Erosive Bank Length	102.00	ft	"
Percent Erosive Bank	1.6	%	"
Eroding Area (AE)	112.80	ft^2	"
Lateral Recession Rate (RLR)	0.0175		"
Bank Erosion (E)	0.10	tons/year	"
Total Bank Erosion Rate (ER)	0.17	tons/mile/year	Reach and Segment
Total Bank Erosion	1.39	tons/year	"

Recession Rate Calculations

Factor	**Field Stability Score**	**Erosion Severity Reduction**
Bank Erosion Evidence (0 to 3)	0.25	1.5
Bank Stability Condition (0 to 3)	0	1.5
Bank Cover/Vegetation(0 to 3)	0	1.5
Lateral Channel Stability (0 to 3)	0.25	1.5
Channel Bottom Stability (0 to 2)	0.25	1
In-Channel Deposition (-1 to 1)	0	1
Total = Slight (0-4); Moderate (4-8); Severe (>8)	0.75	8
Lateral Recession Rate (RLR) (ft/yr)	**0.0175**	**0.15**

Load Capacity Streambank Erosion Calculations for Total Reach		**Unit**	**Area Applied**
Eroding Area at Load Capacity (AE)	1442.07	ft^2	Inventoried Segment
Bank Erosion at Load Capacity (E)	11.36	tons/year	"
Total Bank Erosion Rate at Load Capacity (ER)	18.39	tons/mile/year	Reach and Segment
Total Bank Erosion at Load Capacity for Reach	152.69	tons/year	Total Reach

Summary of Loads

Current Load		**Load Capacity**			
Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Load Reduction Required?	Margin of Safety (tons/yr)
0.2	**1.4**	**18.4**	**152.7**	**No**	**0**

Percent Erosion Reduction (%)	**0**
Total Erosion Reduction (tons/yr)	**0**

AU ID17040215SK006_04 inventory location.

McNeil Core Depth Fine						
Stream:	Upper Irving Creek					
Date (mm/dd/yyyy):	8/25/2014					
Site Description:	Downstream of USFS Fence					
Lat/Lon:	44.46054 N / -112.61879					
Lat/Lon accuracy:			meters			
Datum:	WGS 72					
Samping Event ID	ID17040215SK012_02					
Personnel:	J Fales, J Heaton					
Rosgen Channel:	C					
Habitat Unit	Pool Tailout					
Reach Gradient (%):	2					
Geology (Q, G, V, or S):	S					
Target Species:	Trout					
Flow (cfs):	~1.5					
Surrounding Land Use:	Range					
Sample number		1	2	3		
Ocular est. % surface fines						
Sieve size		(mL)	(mL)	(mL)		
63 mm (2.5")		1610	750	330		
25 mm (1.0")		820	810	630		
12.5 mm (0.5")		280	430	440		
6.34 mm (0.25")		140	260	330		
1.0 - 0.25" Subtotal		1240	1500	1400		
4.75 mm (0.187")		80	100	100		
2.36 mm (0.0937")		180	230	170		
850 µm (0.0331")		180	250	300		
212 µm (0.0083")		320	340	400		
106 µm (0.0041")						
75 µm (0.0029")						
53 µm (0.0021")		100	30	140		
Bottom pan (< 53 µm)						
< 0.25" Subtotal		860	950	1110		
Sample total w/o 2.5" particles		2100	2450	2510	Mean	STDDEV
% fines w/o 2.5" particles		0.40952381	0.387755102	0.442231076	0.41317	0.022389
Sample total w/ 2.5" particles		3710	3200	2840	Mean	STDDEV
% fines w/ 2.5" particles		0.23180593	0.296875	0.39084507	0.306509	0.065284

McNeil Core Depth Fine						
Stream:	Lower Irving Creek					
Date (mm/dd/yyyy):	8/26/2014					
Site Description:	Stream access road off main Irving Creek Road					
Lat/Lon:	44.43541 N / -112.61854					
Lat/Lon accuracy:			meters			
Datum:	WGS 72					
Samping Event ID	ID17040215SK012_03					
Personnel:	J Fales, J Heaton					
Rosgen Channel:	C					
Habitat Unit	Pool Tailout					
Reach Gradient (%):	2					
Geology (Q, G, V, or S):	S					
Target Species:	Trout					
Flow (cfs):	~6					
Surrounding Land Use:	Range, Recreation					
Sample number		1	2	3		
Ocular est. % surface fines						
Sieve size		(mL)	(mL)	(mL)		
63 mm (2.5")		390	0	0		
25 mm (1.0")		800	1600	1420		
12.5 mm (0.5")		670	1090	510		
6.34 mm (0.25")		470	640	320		
1.0 - 0.25" Subtotal		1940	3330	2250		
4.75 mm (0.187")		160	230	120		
2.36 mm (0.0937")		110	560	290		
850 µm (0.0331")		240	850	460		
212 µm (0.0083")		900	670	620		
106 µm (0.0041")						
75 µm (0.0029")						
53 µm (0.0021")		20	150	190		
Bottom pan (< 53 µm)						
< 0.25" Subtotal		1430	2460	1680		
Sample total w/o 2.5" particles		3370	5790	3930	Mean	STDDEV
% fines w/o 2.5" particles		0.424332344	0.424870466	0.427480916	0.425561	0.001375
Sample total w/ 2.5" particles		3760	5790	3930	Mean	STDDEV
% fines w/ 2.5" particles		0.380319149	0.424870466	0.427480916	0.41089	0.021643

McNeil Core Depth Fine						
Stream:	Upper Middle Creek					
Date (mm/dd/yyyy):	8/25/2014					
Site Description:	Upstream of Ford Crossing					
Lat/Lon:	44.41136 N / -112.49100					
Lat/Lon accuracy:			meters			
Datum:	WGS 72					
Samping Event ID	ID17040215SK008_02					
Personnel:	J Fales, J Heaton					
Rosgen Channel:	C					
Habitat Unit	Pool Tailout					
Reach Gradient (%):	2.5					
Geology (Q, G, V, or S):	G					
Target Species:	Trout					
Flow (cfs):	~2.5					
Surrounding Land Use:	Range					
Sample number		1	2	3		
Ocular est. % surface fines						
Sieve size		(mL)	(mL)	(mL)		
63 mm (2.5")		100	1710	1000		
25 mm (1.0")		760	980	1990		
12.5 mm (0.5")		770	450	940		
6.34 mm (0.25")		600	460	880		
1.0 - 0.25" Subtotal		2130	1890	3810		
4.75 mm (0.187")		240	130	340		
2.36 mm (0.0937")		510	260	720		
850 µm (0.0331")		440	270	570		
212 µm (0.0083")		350	260	470		
106 µm (0.0041")						
75 µm (0.0029")						
53 µm (0.0021")		220	20	140		
Bottom pan (< 53 µm)						
< 0.25" Subtotal		1760	940	2240		
Sample total w/o 2.5" particles		3890	2830	6050	Mean	STDDEV
% fines w/o 2.5" particles		0.452442159	0.332155477	0.370247934	0.384949	0.050195
Sample total w/ 2.5" particles		3990	4540	7050	Mean	STDDEV
% fines w/ 2.5" particles		0.441102757	0.207048458	0.317730496	0.321961	0.095599

McNeil Core Depth Fine						
Stream:	Medicine Lodge Creek					
Date (mm/dd/yyyy):	8/27/2014					
Site Description:	Upstream of 2013 BURP Site					
Lat/Lon:	44.31720 N / -112.55538					
Lat/Lon accuracy:			meters			
Datum:	WGS 72					
Samping Event ID	ID17040215SK006_04					
Personnel:	J Fales, J Heaton					
Rosgen Channel:	C					
Habitat Unit	Pool Tailout					
Reach Gradient (%):	2					
Geology (Q, G, V, or S):	S					
Target Species:	Trout					
Flow (cfs):	~30					
Surrounding Land Use:	Range, Recreation					
Sample number		1	2	3		
Ocular est. % surface fines						
Sieve size		(mL)	(mL)	(mL)		
63 mm (2.5")		0	530	570		
25 mm (1.0")		1060	2230	1800		
12.5 mm (0.5")		1050	1340	930		
6.34 mm (0.25")		460	420	610		
1.0 - 0.25" Subtotal		2570	3990	3340		
4.75 mm (0.187")		120	150	150		
2.36 mm (0.0937")		220	170	290		
850 µm (0.0331")		270	150	210		
212 µm (0.0083")		230	130	220		
106 µm (0.0041")						
75 µm (0.0029")						
53 µm (0.0021")		70	20	70		
Bottom pan (< 53 µm)						
< 0.25" Subtotal		910	620	940		
Sample total w/o 2.5" particles		3480	4610	4280	Mean	STDDEV
% fines w/o 2.5" particles		0.261494253	0.134490239	0.219626168	0.205204	0.052843
Sample total w/ 2.5" particles		3480	5140	4850	Mean	STDDEV
% fines w/ 2.5" particles		0.261494253	0.120622568	0.193814433	0.191977	0.057525

Appendix E. Temperature TMDL Data Sources

Table E-1. Data sources for Medicine Lodge Creek subbasin streams.

Water Body	Data Source	Type of Data	Collection Date
Medicine Lodge Creek Subbasin—22 AUs	DEQ State Technical Services Office	Aerial photo interpretation of existing shade, Solar Pathfinder data, and stream width estimation	November 2012—October 2014; 2003, TMDL temperature data

Table E-2. Bankfull width estimates in meters based on drainage area for various locations.

Location	area (sq mi)	Upper Snake (m)	Salmon (m)	Payette/Weiser (m)	Elevation (ft)
Medicine Lodge Creek ab 002_04	260.9	18	25	28	5470
Medicine Lodge Creek bl Webber Cr.	135.05	14	19	20	6200
Medicine Lodge Creek bl Irving Cr.	86.55	11	16	16	6440
Medicine Lodge Creek bl Fritz Cr.	54.82	9	14	12	6520
Warm Creek @ mouth	39.21	8	12	10	6540
Warm Creek bl Divide Cr.	24.5	6	10	8	6720
Warm Creek ab Divide Cr.	9.51	4	7	5	6720
Warm Creek ab Limestone Gulch	3.14	3	5	3	7300
Limestone Gulch @ mouth	1.48	2	3	2	7300
tributary bl Limestone G.	1.4	2	3	2	7100
Black Canyon @ mouth	2.64	2	4	2	6830
tributary bl Divide Cr.	1.64	2	4	2	6590
Horse Creek @ mouth	8.56	4	7	5	6540
Horse Creek ab tributary	2.98	3	5	3	7030
tributary to Horse Cr.	2.13	2	4	2	7030
tributary across from Horse Cr.	0.69	1	3	1	6540
Fritz Creek @ mouth	15.61	5	9	6	6540
Fritz Creek bl NF/SF confluence	11.14	5	7	5	6900
NF Fritz Creek @ mouth	6.54	4	6	4	6900
SF Fritz Creek @ mouth	4.58	3	5	3	6900
Buckboard Gulch @ mouth	1.51	2	4	2	6820
tributary to Medicine Lodge bl Fritz	2.3	2	4	2	6490
Cold Creek @ mouth	8.27	4	7	5	6470
Cold Creek ab Cole Canyon	0.83	1	3	1	6670
Cole Canyon ab Cold Creek	6.19	3	6	4	6670
Cole Canyon ab Poison Gulch	3.46	3	5	3	6700
Poison Gulch @ mouth	1.83	2	4	2	6720
Irving Creek @ mouth	19.87	6	9	7	6440
Irving Creek ab The Bull Pen Cr.	7.38	4	6	4	6720
Irving Creek ab Red Canyon	2.82	2	4	3	7090
Red Canyon @ mouth	1.26	2	3	2	7090
Bear Canyon @ mouth	1.16	2	3	2	7070
The Bull Pen @ mouth	9.52	4	7	5	6730
Deer Canyon @ mouth	1.42	2	3	2	6860
The Bull Pen ab Deer Canyon	5.72	3	6	4	6860
tributary to Medicine Lodge bl Irving	1.42	2	3	2	6360
2nd tributary to Medicine Lodge	2.11	2	4	2	6290
3rd tributary to Medicine Lodge	3.72	3	5	3	6230
Edie Creek @ mouth	11.35	5	8	5	6220
Edie Creek ab tributary	8.16	4	7	5	6540
tributary to Edie Creek	1.75	2	4	2	6540
Webber Creek @ mouth	26.53	7	10	8	6220
Webber Creek ab McNeary Cr.	17.4	6	9	7	6590
Webber Creek ab SF Webber Cr.	8.45	4	7	5	7430
NF Webber Creek ab tributary	3.73	3	5	3	7630
tributary to NF Webber Cr.	3.6	3	5	3	7630
SF Webber Creek @ mouth	2.45	2	4	2	7430
tributary to Webber Cr.	0.75	1	3	1	7160
McNeary Creek @ mouth	3.33	3	5	3	6600
Robertson Gulch @ mouth	3.22	3	5	3	6400
Robertson Gulch ab tributary	1.07	2	3	2	6900
tributary to Robertson Gulch	0.98	2	3	1	6890

Table E-3. Bankfull width estimates in meters based on drainage area for various locations.

Location	area (sq mi)	Upper Snake (m)	Salmon (m)	Payette/Weiser (m)	Elevation (ft)
Middle Creek @ mouth	47.75	9	13	12	5550
Middle Creek ab Dead Horse Cr.	23.44	6	10	8	6090
Middle Creek ab Dry Cr.	14.56	5	8	6	6520
Middle Creek ab Broad Hollow	6.94	4	6	4	6940
Rocky Creek @ mouth	15.01	5	8	6	5720
Rocky Creek ab tributary	8.67	4	7	5	5960
tributary to Rocky Cr.	5.38	3	6	4	5960
Dead Horse Creek @ mouth	3.47	3	5	3	6100
Dead Horse Creek ab tributary	1.28	2	3	2	6560
tributary to Dead Horse Cr.	0.73	1	3	1	6560
Wood Canyon @ mouth	1.15	2	3	2	6610
Poison Creek @ mouth	2.21	2	4	2	6810
Broad Hollow @ mouth	1.4	2	3	2	6930
Indian Creek @ mouth	49.86	9	13	12	5500
Indian Creek bl EF/WF confluence	33.22	7	11	10	6060
1st tributary to Indian Cr.	1.32	2	3	2	5750
2nd tributary to Indian Cr.	7.09	4	6	4	5540
Deep Creek @ canyon mouth	32.69	7	11	9	5150
Deep Creek @ 5630ft	23.29	6	10	8	5630
Deep Creek @ 6210ft	13.87	5	8	6	6210
Deep Creek ab SF Deep Cr.	8.03	4	7	4	6450
Deep Creek ab 1st tributary	2.85	2	4	3	6740
1st tributary to Deep Cr.	1.74	2	4	2	6740
SF Deep Creek @ 6710ft	3.61	3	5	3	6710
2nd tributary to Deep Cr.	0.53	1	2	1	6510
4th tributary to Deep Cr.	1.75	2	4	2	5960
5th tributary to Deep Cr.	4.95	3	6	3	5640
6th tributary to Deep Cr.	1.55	2	4	2	5180
1st tributary north of Deep Cr.	7.21	4	6	4	5200
2nd tributary north of Deep Cr.	17.44	6	9	7	5320
2nd tributary ab its 1st tributary	8.53	4	7	5	5700
Crooked Creek bl Shamrock Gulch	53.68	9	14	12	6060
Crooked Creek bl Myers Cr.	24.52	6	10	8	6280
Crooked Creek ab Myers Cr.	18.34	6	9	7	6300
Crooked Creek bl 2nd tributary	9.31	4	7	5	7180
Crooked Creek ab 1st tributary	4.8	3	5	3	7490
1st tributary to Crooked Cr.	0.85	1	3	1	7500
2nd tributary to Crooked Cr.	2.17	2	4	2	7190
3rd tributary to Crooked Cr.	0.82	1	3	1	6820
Heart Canyon @ 6780ft	1.21	2	3	2	6780
Myers Creek @ mouth	5.8	3	6	4	6380
Nicholia Canyon @ 6700ft	14.97	5	8	6	6700
Nicholia Canyon ab Buckhorn Canyon	9.5	4	7	5	6840
Nicholia Canyon ab 1st tributary	6.41	4	6	4	7030
1st tributary to Nicholia Canyon	2.25	2	4	2	7040
Buckhorn Canyon @ mouth	4.88	3	5	3	6840
Black Horse Creek @ 6320ft	2.95	3	5	3	6320
Shamrock Gulch @ mouth	1.92	2	4	2	6080

Table E-4. Existing and target solar loads for Crooked Creek (ID17040215SK021_02).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
021_02	Crooked Creek	1	1300	EU# 1133(1760)	71%	1.72	1	1,000	2,000	50%	2.97	1	1,000	3,000	1,000	-21%
021_02	Crooked Creek	2	1300	EU# 2606	58%	2.49	2	3,000	7,000	70%	1.78	2	3,000	5,000	(2,000)	0%
021_02	Crooked Creek	3	490	EU# 2606	58%	2.49	2	1,000	2,000	70%	1.78	2	1,000	2,000	0	0%
021_02	Crooked Creek	4	670	EU# 2606	43%	3.39	3	2,000	7,000	40%	3.56	3	2,000	7,000	0	-3%
021_02	Crooked Creek	5	390	EU# 2606	43%	3.39	3	1,000	3,000	20%	4.75	3	1,000	5,000	2,000	-23%
021_02	Crooked Creek	6	400	EU# 2606	43%	3.39	3	1,000	3,000	40%	3.56	3	1,000	4,000	1,000	-3%
021_02	Crooked Creek	7	270	EU# 2606	35%	3.86	4	1,000	4,000	40%	3.56	4	1,000	4,000	0	0%
021_02	Crooked Creek	8	220	alder	59%	2.44	4	900	2,000	70%	1.78	4	900	2,000	0	0%
021_02	Crooked Creek	9	150	alder	59%	2.44	4	600	1,000	60%	2.38	4	600	1,000	0	0%
021_02	Crooked Creek	10	90	alder	59%	2.44	4	400	1,000	0%	5.94	4	400	2,000	1,000	-59%
021_02	Crooked Creek	11	270	alder	59%	2.44	4	1,000	2,000	50%	2.97	4	1,000	3,000	1,000	-9%
021_02	Crooked Creek	12	110	alder	59%	2.44	4	400	1,000	50%	2.97	4	400	1,000	0	-9%
021_02	Crooked Creek	13	470	alder	59%	2.44	4	2,000	5,000	50%	2.97	4	2,000	6,000	1,000	-9%
021_02	Crooked Creek	14	890	alder	59%	2.44	4	4,000	10,000	60%	2.38	4	4,000	10,000	0	0%
021_02	Crooked Creek	15	530	alder	59%	2.44	4	2,000	5,000	60%	2.38	4	2,000	5,000	0	0%
021_02	Crooked Creek	16	360	alder	59%	2.44	4	1,000	2,000	50%	2.97	4	1,000	3,000	1,000	-9%
021_02	Crooked Creek	17	250	alder	50%	2.97	5	1,000	3,000	60%	2.38	5	1,000	2,000	(1,000)	0%
021_02	Crooked Creek	18	350	alder	50%	2.97	5	2,000	6,000	40%	3.56	5	2,000	7,000	1,000	-10%
021_02	Crooked Creek	19	220	alder	50%	2.97	5	1,000	3,000	50%	2.97	5	1,000	3,000	0	0%
021_02	Crooked Creek	20	350	alder	50%	2.97	5	2,000	6,000	60%	2.38	5	2,000	5,000	(1,000)	0%
021_02	Crooked Creek	21	220	alder	50%	2.97	5	1,000	3,000	50%	2.97	5	1,000	3,000	0	0%
021_02	Crooked Creek	22	480	alder	50%	2.97	5	2,000	6,000	70%	1.78	5	2,000	4,000	(2,000)	0%
021_02	Crooked Creek	23	1650	alder	50%	2.97	5	8,000	20,000	20%	4.75	5	8,000	40,000	20,000	-30%
021_02	Crooked Creek	24	100	alder	43%	3.39	6	600	2,000	50%	2.97	6	600	2,000	0	0%
021_02	Crooked Creek	24	170	alder	43%	3.39	6	1,000	3,000	10%	5.35	6	1,000	5,000	2,000	-33%
021_02	Crooked Creek	24	360	alder	43%	3.39	6	2,000	7,000	50%	2.97	6	2,000	6,000	(1,000)	0%
021_02	Crooked Creek	25	410	Geyer willow	40%	3.56	6	2,000	7,000	50%	2.97	6	2,000	6,000	(1,000)	0%
021_02	Crooked Creek	26	540	Geyer willow	40%	3.56	6	3,000	10,000	10%	5.35	6	3,000	20,000	10,000	-30%
021_02	Crooked Creek	27	800	Geyer willow	40%	3.56	6	5,000	20,000	30%	4.16	6	5,000	20,000	0	-10%
021_02	Crooked Creek	28	160	Geyer willow	40%	3.56	6	1,000	4,000	10%	5.35	6	1,000	5,000	1,000	-30%
021_02	1st tributary	1	380	EU# 1133(1760)	71%	1.72	1	400	700	80%	1.19	1	400	500	(200)	0%
021_02	1st tributary	2	680	EU# 1133(1760)	71%	1.72	1	700	1,000	40%	3.56	1	700	2,000	1,000	-31%
021_02	1st tributary	3	230	EU# 1133(1760)	71%	1.72	1	200	300	60%	2.38	1	200	500	200	-11%
021_02	1st tributary	4	610	EU# 2606	88%	0.71	1	600	400	90%	0.59	1	600	400	0	0%
021_02	2nd tributary	1	860	EU# 1154	65%	2.08	1	900	2,000	30%	4.16	1	900	4,000	2,000	-35%
021_02	2nd tributary	2	320	EU# 1129	60%	2.38	1	300	700	60%	2.38	1	300	700	0	0%
021_02	2nd tributary	3	750	EU# 1129	59%	2.44	2	2,000	5,000	40%	3.56	2	2,000	7,000	2,000	-19%
021_02	2nd tributary	4	240	EU# 1129	59%	2.44	2	500	1,000	60%	2.38	2	500	1,000	0	0%
021_02	2nd tributary	5	220	EU# 1129	59%	2.44	2	400	1,000	40%	3.56	2	400	1,000	0	-19%

Table E-4. continued.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
021_02	3rd tributary	1	1600	EU# 1133(1760)	71%	1.72	1	2,000	3,000	30%	4.16	1	2,000	8,000	5,000	-41%
021_02	3rd tributary	2	420	EU# 1129	60%	2.38	1	400	1,000	80%	1.19	1	400	500	(500)	0%
021_02	3rd tributary	3	230	sage/grass	65%	2.08	1	200	400	60%	2.38	1	200	500	100	-5%
021_02	3rd tributary	4	130	alder	91%	0.53	1	100	50	80%	1.19	1	100	100	50	-11%
021_02	Heart Canyon	1	490	grass	55%	2.67	1	500	1,000	60%	2.38	1	500	1,000	0	0%
021_02	Heart Canyon	2	2110	ephemeral												
021_02	Myers Creek	1	360	EU# 1129	60%	2.38	1	400	1,000	70%	1.78	1	400	700	(300)	0%
021_02	Myers Creek	2	590	EU# 1129	60%	2.38	1	600	1,000	50%	2.97	1	600	2,000	1,000	-10%
021_02	Myers Creek	3	930	EU# 2606	88%	0.71	1	900	600	50%	2.97	1	900	3,000	2,000	-38%
021_02	Myers Creek	4	250	EU# 2606	88%	0.71	1	300	200	60%	2.38	1	300	700	500	-28%
021_02	Myers Creek	5	830	grass	55%	2.67	1	800	2,000	40%	3.56	1	800	3,000	1,000	-15%
021_02	Myers Creek	6	350	EU# 2606	58%	2.49	2	700	2,000	60%	2.38	2	700	2,000	0	0%
021_02	Myers Creek	7	640	EU# 2606	58%	2.49	2	1,000	2,000	50%	2.97	2	1,000	3,000	1,000	-8%
021_02	Myers Creek	8	400	alder	86%	0.83	2	800	700	80%	1.19	2	800	1,000	300	-6%
021_02	Myers Creek	9	51	alder	86%	0.83	2	100	80	30%	4.16	2	100	400	300	-56%
021_02	Myers Creek	10	270	alder	86%	0.83	2	500	400	70%	1.78	2	500	900	500	-16%
021_02	Myers Creek	11	190	alder	86%	0.83	2	400	300	70%	1.78	2	400	700	400	-16%
021_02	Myers Creek	12	240	alder	86%	0.83	2	500	400	50%	2.97	2	500	1,000	600	-36%
021_02	Myers Creek	13	690	alder	86%	0.83	2	1,000	800	70%	1.78	2	1,000	2,000	1,000	-16%
021_02	Myers Creek	14	2200	Geyer willow	64%	2.14	3	7,000	10,000	0%	5.94	3	7,000	40,000	30,000	-64%
021_02	Myers Creek	15	290	Geyer willow	64%	2.14	3	900	2,000	10%	5.35	3	900	5,000	3,000	-54%
021_02	Myers Creek	16	170	Geyer willow	64%	2.14	3	500	1,000	40%	3.56	3	500	2,000	1,000	-24%
021_02	Nicholia Canyon	1	480	ephemeral												
021_02	Nicholia Canyon	2	580	EU# 1129	59%	2.44	2	1,000	2,000	50%	2.97	2	1,000	3,000	1,000	-9%
021_02	Nicholia Canyon	3	500	EU# 1129	56%	2.61	3	2,000	5,000	70%	1.78	3	2,000	4,000	(1,000)	0%
021_02	Nicholia Canyon	4	10600	ephemeral												
021_02	Buckhorn Canyon	1	630	ephemeral												
021_02	Buckhorn Canyon	2	1200	EU# 1129	60%	2.38	1	1,000	2,000	70%	1.78	1	1,000	2,000	0	0%
021_02	Buckhorn Canyon	3	1100	EU# 1133(1760)	48%	3.09	2	2,000	6,000	70%	1.78	2	2,000	4,000	(2,000)	0%
021_02	Buckhorn Canyon	4	290	EU# 1133(1760)	48%	3.09	2	600	2,000	40%	3.56	2	600	2,000	0	-8%
021_02	Buckhorn Canyon	5	77	EU# 1133(1760)	48%	3.09	2	200	600	40%	3.56	2	200	700	100	-8%
021_02	Buckhorn Canyon	6	770	EU# 1133(1760)	48%	3.09	2	2,000	6,000	70%	1.78	2	2,000	4,000	(2,000)	0%
021_02	Buckhorn Canyon	7	1300	ephemeral												
021_02	1st trib to Nicholia	1	520	EU# 1129	60%	2.38	1	500	1,000	80%	1.19	1	500	600	(400)	0%
021_02	1st trib to Nicholia	2	820	EU# 1133(1760)	71%	1.72	1	800	1,000	70%	1.78	1	800	1,000	0	-1%
021_02	1st trib to Nicholia	3	3830	ephemeral												
021_02	Slate Basin	1	5800	ephemeral												
021_02	trib to Slate Basin	1	2410	ephemeral												
021_02	Black Horse Canyon	1	6030	ephemeral												
021_02	1st trib to Black Horse	1	2370	ephemeral												
021_02	2nd trib to Black Hors	1	2860	ephemeral												
021_02	Shamrock Gulch	1	4440	ephemeral												
021_02	last trib to Crooked	1	4700	ephemeral												
							Totals		220,000					310,000	82,000	

Note: All assessment unit (AU) numbers start with ID17040211SK in all load tables (Tables D-4 to D-25). Significant figures are controlled by the lowest level in the calculation, typically that of the channel width. Some rounding errors may result.

Table E-5. Existing and target solar loads for Crooked Creek (ID17040215SK021_03).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
021_03	Crooked Creek	1	1600	Geyer willow	31%	4.10	8	10,000	40,000	20%	4.75	8	10,000	50,000	10,000	-11%
021_03	Crooked Creek	2	1100	Geyer willow	31%	4.10	8	9,000	40,000	0%	5.94	8	9,000	50,000	10,000	-31%
021_03	Crooked Creek	3	980	Geyer willow	29%	4.22	9	9,000	40,000	0%	5.94	9	9,000	50,000	10,000	-29%
021_03	Crooked Creek	4	510	Geyer willow	29%	4.22	9	5,000	20,000	0%	5.94	9	5,000	30,000	10,000	-29%
021_03	Crooked Creek	5	1200	ephemeral												
							Totals		140,000					180,000	40,000	

Table E-6. Existing and target solar loads for Deep Creek (ID17040215SK018_02).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
018_02	Deep Creek	1	1100	EU# 1129	60%	2.38	1	1,000	2,000	80%	1.19	1	1,000	1,000	(1,000)	0%
018_02	Deep Creek	2	120	EU# 1129	60%	2.38	1	100	200	70%	1.78	1	100	200	0	0%
018_02	Deep Creek	3	300	EU# 1129	60%	2.38	1	300	700	60%	2.38	1	300	700	0	0%
018_02	Deep Creek	4	600	EU# 1128	65%	2.08	1	600	1,000	60%	2.38	1	600	1,000	0	-5%
018_02	Deep Creek	5	350	EU# 1129	59%	2.44	2	700	2,000	70%	1.78	2	700	1,000	(1,000)	0%
018_02	Deep Creek	6	1400	grass	31%	4.10	2	3,000	10,000	30%	4.16	2	3,000	10,000	0	-1%
018_02	Deep Creek	7	120	grass	21%	4.69	3	400	2,000	10%	5.35	3	400	2,000	0	-11%
018_02	Deep Creek	8	360	Geyer willow	64%	2.14	3	1,000	2,000	40%	3.56	3	1,000	4,000	2,000	-24%
018_02	Deep Creek	9	150	Geyer willow	64%	2.14	3	500	1,000	30%	4.16	3	500	2,000	1,000	-34%
018_02	Deep Creek	10	380	sage/grass	27%	4.34	3	1,000	4,000	20%	4.75	3	1,000	5,000	1,000	-7%
018_02	Deep Creek	11	1150	ephemeral												
018_02	Deep Creek	12	2580	grass	16%	4.99	4	10,000	50,000	10%	5.35	4	10,000	50,000	0	-6%
018_02	Deep Creek	13	170	Geyer willow	45%	3.27	5	900	3,000	30%	4.16	5	900	4,000	1,000	-15%
018_02	Deep Creek	14	290	Geyer willow	45%	3.27	5	1,000	3,000	20%	4.75	5	1,000	5,000	2,000	-25%
018_02	Deep Creek	15	130	Geyer willow	45%	3.27	5	700	2,000	10%	5.35	5	700	4,000	2,000	-35%
018_02	Deep Creek	16	360	Geyer willow	45%	3.27	5	2,000	7,000	30%	4.16	5	2,000	8,000	1,000	-15%
018_02	Deep Creek	17	1280	sage/grass	17%	4.93	5	6,000	30,000	10%	5.35	5	6,000	30,000	0	-7%
018_02	Deep Creek	18	1800	sage/grass	17%	4.93	5	9,000	40,000	0%	5.94	5	9,000	50,000	10,000	-17%
018_02	Deep Creek	19	1100	sage/grass	14%	5.11	6	7,000	40,000	10%	5.35	6	7,000	40,000	0	-4%
018_02	Deep Creek	20	360	Geyer willow	40%	3.56	6	2,000	7,000	30%	4.16	6	2,000	8,000	1,000	-10%
018_02	Deep Creek	21	2200	sage/grass	14%	5.11	6	10,000	50,000	0%	5.94	6	10,000	60,000	10,000	-14%
018_02	Deep Creek	22	820	ephemeral												
018_02	1st tributary	1	2110	ephemeral												
018_02	SF Deep Creek	1	230	EU# 1133(1760)	71%	1.72	1	200	300	80%	1.19	1	200	200	(100)	0%
018_02	SF Deep Creek	2	1100	EU# 1128	65%	2.08	1	1,000	2,000	60%	2.38	1	1,000	2,000	0	-5%
018_02	SF Deep Creek	3	460	EU# 1128	39%	3.62	2	900	3,000	40%	3.56	2	900	3,000	0	0%
018_02	SF Deep Creek	4	210	Geyer willow	82%	1.07	2	400	400	50%	2.97	2	400	1,000	600	-32%
018_02	SF Deep Creek	5	290	Geyer willow	82%	1.07	2	600	600	70%	1.78	2	600	1,000	400	-12%
018_02	SF Deep Creek	6	53	Geyer willow	82%	1.07	2	100	100	30%	4.16	2	100	400	300	-52%
018_02	SF Deep Creek	7	200	Geyer willow	82%	1.07	2	400	400	60%	2.38	2	400	1,000	600	-22%
018_02	SF Deep Creek	8	250	Geyer willow	64%	2.14	3	800	2,000	20%	4.75	3	800	4,000	2,000	-44%
018_02	SF Deep Creek	9	96	Geyer willow	64%	2.14	3	300	600	50%	2.97	3	300	900	300	-14%
018_02	SF Deep Creek	10	3500	grass	21%	4.69	3	10,000	50,000	10%	5.35	3	10,000	50,000	0	-11%
018_02	3rd tributary	1	2670	ephemeral												
018_02	4th tributary	1	290	Geyer willow	93%	0.42	1	300	100	70%	1.78	1	300	500	400	-23%
018_02	4th tributary	2	2500	ephemeral												
018_02	5th tributary	1	2880	ephemeral												
018_02	6th tributary	1	3300	ephemeral												
018_02	7th tributary	1	4840	ephemeral												
018_02	8th tributary	1	5400	ephemeral												
018_02	9th tributary	1	6430	ephemeral												
018_02	10th tributary	1	24000	ephemeral												
018_02	11th tributary	1	37200	ephemeral												
							Totals		320,000					350,000	34,000	

Table E-7. Existing and target solar loads for Deep Creek (ID17040215SK018_03).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
018_03	Deep Creek	1	13700	ephemeral												
							Totals		0					0	0	

Table E-8. Existing and target solar loads for Edie Creek (ID17040215SK010_02).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
010_02	Edie Creek	1	2880	ephemeral												
010_02	Edie Creek	2	1200	Geyer willow	82%	1.07	2	2,000	2,000	70%	1.78	2	2,000	4,000	2,000	-12%
010_02	Edie Creek	3	240	Geyer willow	82%	1.07	2	500	500	50%	2.97	2	500	1,000	500	-32%
010_02	Edie Creek	4	350	Geyer willow	82%	1.07	2	700	700	40%	3.56	2	700	2,000	1,000	-42%
010_02	Edie Creek	5	190	Geyer willow	82%	1.07	2	400	400	20%	4.75	2	400	2,000	2,000	-62%
010_02	Edie Creek	6	610	Geyer willow	64%	2.14	3	2,000	4,000	50%	2.97	3	2,000	6,000	2,000	-14%
010_02	Edie Creek	7	390	Geyer willow	64%	2.14	3	1,000	2,000	20%	4.75	3	1,000	5,000	3,000	-44%
010_02	Edie Creek	8	380	Geyer willow	64%	2.14	3	1,000	2,000	30%	4.16	3	1,000	4,000	2,000	-34%
010_02	Edie Creek	9	460	Geyer willow	64%	2.14	3	1,000	2,000	50%	2.97	3	1,000	3,000	1,000	-14%
010_02	Edie Creek	10	800	Geyer willow	64%	2.14	3	2,000	4,000	30%	4.16	3	2,000	8,000	4,000	-34%
010_02	Edie Creek	11	430	Geyer willow	53%	2.79	4	2,000	6,000	30%	4.16	4	2,000	8,000	2,000	-23%
010_02	Edie Creek	12	200	Geyer willow	53%	2.79	4	800	2,000	10%	5.35	4	800	4,000	2,000	-43%
010_02	Edie Creek	13	440	Geyer willow	53%	2.79	4	2,000	6,000	30%	4.16	4	2,000	8,000	2,000	-23%
010_02	Edie Creek	14	880	Geyer willow	53%	2.79	4	4,000	10,000	40%	3.56	4	4,000	10,000	0	-13%
010_02	Edie Creek	15	360	Geyer willow	53%	2.79	4	1,000	3,000	30%	4.16	4	1,000	4,000	1,000	-23%
010_02	Edie Creek	16	730	Geyer willow	45%	3.27	5	4,000	10,000	40%	3.56	5	4,000	10,000	0	-5%
010_02	Edie Creek	17	130	Geyer willow	45%	3.27	5	700	2,000	0%	5.94	5	700	4,000	2,000	-45%
010_02	Edie Creek	18	920	Geyer willow	45%	3.27	5	5,000	20,000	40%	3.56	5	5,000	20,000	0	-5%
010_02	Edie Creek	19	520	Geyer willow	45%	3.27	5	3,000	10,000	50%	2.97	5	3,000	9,000	(1,000)	0%
010_02	Edie trib	1	590	grass	55%	2.67	1	600	2,000	60%	2.38	1	600	1,000	(1,000)	0%
010_02	Edie trib	2	3760	ephemeral												
010_02	Edie trib	3	430	grass	31%	4.10	2	900	4,000	30%	4.16	2	900	4,000	0	-1%
							Totals		93,000					120,000	25,000	

Table E-9. Existing and target solar loads for Fritz Creek (ID17040215SK016_02).

Segment Details					Target						Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
016_02	North Fork Fritz Creek	1	1500	EU# 1154	65%	2.08	1	2,000	4,000	80%	1.19	1	2,000	2,000	(2,000)	0%
016_02	North Fork Fritz Creek	2	680	grass	55%	2.67	1	700	2,000	40%	3.56	1	700	2,000	0	-15%
016_02	North Fork Fritz Creek	3	1200	EU# 2606	58%	2.49	2	2,000	5,000	80%	1.19	2	2,000	2,000	(3,000)	0%
016_02	North Fork Fritz Creek	4	300	grass	31%	4.10	2	600	2,000	30%	4.16	2	600	2,000	0	-1%
016_02	North Fork Fritz Creek	5	360	EU# 2606	58%	2.49	2	700	2,000	70%	1.78	2	700	1,000	(1,000)	0%
016_02	North Fork Fritz Creek	6	790	EU# 2606	43%	3.39	3	2,000	7,000	40%	3.56	3	2,000	7,000	0	-3%
016_02	North Fork Fritz Creek	7	380	EU# 1133(1760)	37%	3.74	3	1,000	4,000	40%	3.56	3	1,000	4,000	0	0%
016_02	North Fork Fritz Creek	8	1100	EU# 1133(1760)	37%	3.74	3	3,000	10,000	60%	2.38	3	3,000	7,000	(3,000)	0%
016_02	North Fork Fritz Creek	9	260	Geyer willow	53%	2.79	4	1,000	3,000	60%	2.38	4	1,000	2,000	(1,000)	0%
016_02	North Fork Fritz Creek	9	310	Geyer willow	53%	2.79	4	1,000	3,000	20%	4.75	4	1,000	5,000	2,000	-33%
016_02	North Fork Fritz Creek	9	950	Geyer willow	53%	2.79	4	4,000	10,000	40%	3.56	4	4,000	10,000	0	-13%
016_02	North Fork Fritz Creek	10	280	Geyer willow	53%	2.79	4	1,000	3,000	10%	5.35	4	1,000	5,000	2,000	-43%
016_02	South Fork Fritz Creek	1	310	EU# 1154	65%	2.08	1	300	600	70%	1.78	1	300	500	(100)	0%
016_02	South Fork Fritz Creek	2	200	EU# 1154	65%	2.08	1	200	400	60%	2.38	1	200	500	100	-5%
016_02	South Fork Fritz Creek	3	1700	EU# 1154	65%	2.08	1	2,000	4,000	80%	1.19	1	2,000	2,000	(2,000)	0%
016_02	South Fork Fritz Creek	3	360	EU# 1154	65%	2.08	1	400	800	60%	2.38	1	400	1,000	200	-5%
016_02	South Fork Fritz Creek	4	240	grass	31%	4.10	2	500	2,000	40%	3.56	2	500	2,000	0	0%
016_02	South Fork Fritz Creek	5	1100	EU# 1129	59%	2.44	2	2,000	5,000	60%	2.38	2	2,000	5,000	0	0%
016_02	South Fork Fritz Creek	4	260	grass	31%	4.10	2	500	2,000	30%	4.16	2	500	2,000	0	-1%
016_02	South Fork Fritz Creek	6	240	EU# 1129	59%	2.44	2	500	1,000	60%	2.38	2	500	1,000	0	0%
016_02	South Fork Fritz Creek	7	2490	ephemeral												
016_02	Fritz Creek	1	110	Geyer willow	45%	3.27	5	600	2,000	30%	4.16	5	600	2,000	0	-15%
016_02	Fritz Creek	2	3000	Geyer willow	45%	3.27	5	20,000	70,000	0%	5.94	5	20,000	100,000	30,000	-45%
016_02	Fritz Creek	3	800	EU# 1129	43%	3.39	5	4,000	10,000	50%	2.97	5	4,000	10,000	0	0%
016_02	Fritz Creek	4	610	Geyer willow	45%	3.27	5	3,000	10,000	10%	5.35	5	3,000	20,000	10,000	-35%
016_02	Fritz Creek	5	140	Geyer willow	45%	3.27	5	700	2,000	40%	3.56	5	700	2,000	0	-5%
016_02	Buckboard Gulch	1	250	EU# 1129	60%	2.38	1	300	700	90%	0.59	1	300	200	(500)	0%
016_02	Buckboard Gulch	2	93	EU# 1129	60%	2.38	1	90	200	60%	2.38	1	90	200	0	0%
016_02	Buckboard Gulch	3	120	EU# 1133(1760)	71%	1.72	1	100	200	90%	0.59	1	100	60	(100)	0%
016_02	Buckboard Gulch	4	59	EU# 1133(1760)	71%	1.72	1	60	100	60%	2.38	1	60	100	0	-11%
016_02	Buckboard Gulch	5	500	EU# 1133(1760)	71%	1.72	1	500	900	90%	0.59	1	500	300	(600)	0%
016_02	Buckboard Gulch	6	710	EU# 1133(1760)	71%	1.72	1	700	1,000	60%	2.38	1	700	2,000	1,000	-11%
016_02	Buckboard Gulch	7	3100	ephemeral												
							Totals		170,000					200,000	32,000	

Table E-10. Existing and target solar loads for Horse Creek (ID17040215SK015_02).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
015_02	Horse Creek	1	1300	sage/grass	65%	2.08	1	1,000	2,000	50%	2.97	1	1,000	3,000	1,000	-15%
015_02	Horse Creek	2	5320	ephemeral												
015_02	Horse Creek	3	310	EU# 1129	56%	2.61	3	900	2,000	70%	1.78	3	900	2,000	0	0%
015_02	Horse Creek	4	360	EU# 1129	48%	3.09	4	1,000	3,000	30%	4.16	4	1,000	4,000	1,000	-18%
015_02	Horse Creek	5	770	EU# 1129	48%	3.09	4	3,000	9,000	60%	2.38	4	3,000	7,000	(2,000)	0%
015_02	Horse Creek	6	1300	Geyer willow	53%	2.79	4	5,000	10,000	40%	3.56	4	5,000	20,000	10,000	-13%
015_02	Horse Creek	7	300	Geyer willow	53%	2.79	4	1,000	3,000	0%	5.94	4	1,000	6,000	3,000	-53%
015_02	Horse Creek	8	270	Geyer willow	53%	2.79	4	1,000	3,000	30%	4.16	4	1,000	4,000	1,000	-23%
015_02	tributary	1	1770	ephemeral												
015_02	tributary	2	1200	sage/grass	39%	3.62	2	2,000	7,000	30%	4.16	2	2,000	8,000	1,000	-9%
015_02	tributary	3	780	ephemeral												
							Totals		39,000					54,000	15,000	

Table E-11. Existing and target solar loads for Indian Creek (ID17040215SK003_02).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
003_02	Indian Creek	1	16900	ephemeral												
							Totals		0					0	0	

Table E-12. Existing and target solar loads for Indian Creek (ID17040215SK003_03).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
003_03	Indian Creek	1	380	cottonwood	75%	1.49	7	3,000	4,000	70%	1.78	7	3,000	5,000	1,000	-5%
003_03	Indian Creek	2	380	cottonwood	75%	1.49	7	3,000	4,000	60%	2.38	7	3,000	7,000	3,000	-15%
003_03	Indian Creek	3	180	cottonwood	75%	1.49	7	1,000	1,000	70%	1.78	7	1,000	2,000	1,000	-5%
003_03	Indian Creek	4	100	cottonwood	75%	1.49	7	700	1,000	50%	2.97	7	700	2,000	1,000	-25%
003_03	Indian Creek	5	470	cottonwood	75%	1.49	7	3,000	4,000	60%	2.38	7	3,000	7,000	3,000	-15%
003_03	Indian Creek	6	44	cottonwood	75%	1.49	7	300	400	0%	5.94	7	300	2,000	2,000	-75%
003_03	Indian Creek	7	430	cottonwood	75%	1.49	7	3,000	4,000	60%	2.38	7	3,000	7,000	3,000	-15%
003_03	Indian Creek	8	1800	cottonwood	75%	1.49	7	10,000	10,000	50%	2.97	7	10,000	30,000	20,000	-25%
003_03	Indian Creek	9	140	cottonwood	75%	1.49	7	1,000	1,000	10%	5.35	7	1,000	5,000	4,000	-65%
003_03	Indian Creek	10	760	cottonwood	75%	1.49	7	5,000	7,000	50%	2.97	7	5,000	10,000	3,000	-25%
003_03	Indian Creek	11	350	cottonwood	69%	1.84	8	3,000	6,000	70%	1.78	8	3,000	5,000	(1,000)	0%
003_03	Indian Creek	12	130	cottonwood	69%	1.84	8	1,000	2,000	50%	2.97	8	1,000	3,000	1,000	-19%
003_03	Indian Creek	13	1670	cottonwood	69%	1.84	8	10,000	20,000	60%	2.38	8	10,000	20,000	0	-9%
003_03	Indian Creek	14	460	cottonwood	69%	1.84	8	4,000	7,000	20%	4.75	8	4,000	20,000	10,000	-49%
003_03	Indian Creek	15	89	cottonwood	69%	1.84	8	700	1,000	50%	2.97	8	700	2,000	1,000	-19%
003_03	Indian Creek	16	130	cottonwood	69%	1.84	8	1,000	2,000	10%	5.35	8	1,000	5,000	3,000	-59%
003_03	Indian Creek	17	560	cottonwood	69%	1.84	8	4,000	7,000	0%	5.94	8	4,000	20,000	10,000	-69%
003_03	Indian Creek	18	700	cottonwood	63%	2.20	9	6,000	10,000	0%	5.94	9	6,000	40,000	30,000	-63%
003_03	Indian Creek	19	390	sandbar willow	32%	4.04	9	4,000	20,000	40%	3.56	9	4,000	10,000	(10,000)	0%
							Totals		110,000					200,000	85,000	

Table E-13. Existing and target solar loads for Irving Creek (ID17040215SK012_02).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
012_02	Irving Creek	1	870	ephemeral												
012_02	Irving Creek	2	370	EU# 1303(1315)	80%	1.19	1	400	500	80%	1.19	1	400	500	0	0%
012_02	Irving Creek	3	390	EU# 1303(1315)	80%	1.19	1	400	500	90%	0.59	1	400	200	(300)	0%
012_02	Irving Creek	4	140	ephemeral												
012_02	Irving Creek	5	510	EU# 1303(1315)	78%	1.31	2	1,000	1,000	80%	1.19	2	1,000	1,000	0	0%
012_02	Irving Creek	6	130	EU# 2606	58%	2.49	2	300	700	90%	0.59	2	300	200	(500)	0%
012_02	Irving Creek	7	290	ephemeral												
012_02	Irving Creek	8	1000	Geyer willow	82%	1.07	2	2,000	2,000	80%	1.19	2	2,000	2,000	0	-2%
012_02	Irving Creek	9	280	Geyer willow	82%	1.07	2	600	600	70%	1.78	2	600	1,000	400	-12%
012_02	Irving Creek	10	180	Geyer willow	64%	2.14	3	500	1,000	30%	4.16	3	500	2,000	1,000	-34%
012_02	Irving Creek	11	79	Geyer willow	64%	2.14	3	200	400	40%	3.56	3	200	700	300	-24%
012_02	Irving Creek	12	170	Geyer willow	64%	2.14	3	500	1,000	70%	1.78	3	500	900	(100)	0%
012_02	Irving Creek	13	450	Geyer willow	64%	2.14	3	1,000	2,000	60%	2.38	3	1,000	2,000	0	-4%
012_02	Irving Creek	13	500	Geyer willow	64%	2.14	3	2,000	4,000	50%	2.97	3	2,000	6,000	2,000	-14%
012_02	Irving Creek	14	230	Geyer willow	64%	2.14	3	700	1,000	40%	3.56	3	700	2,000	1,000	-24%
012_02	Irving Creek	15	120	Geyer willow	53%	2.79	4	500	1,000	40%	3.56	4	500	2,000	1,000	-13%
012_02	Irving Creek	16	300	Geyer willow	53%	2.79	4	1,000	3,000	30%	4.16	4	1,000	4,000	1,000	-23%
012_02	Irving Creek	17	280	Geyer willow	53%	2.79	4	1,000	3,000	50%	2.97	4	1,000	3,000	0	-3%
012_02	Irving Creek	18	260	Geyer willow	53%	2.79	4	1,000	3,000	30%	4.16	4	1,000	4,000	1,000	-23%
012_02	Irving Creek	19	520	Geyer willow	53%	2.79	4	2,000	6,000	40%	3.56	4	2,000	7,000	1,000	-13%
012_02	Red Canyon	1	1600	EU# 1129	60%	2.38	1	2,000	5,000	90%	0.59	1	2,000	1,000	(4,000)	0%
012_02	Red Canyon	2	360	ephemeral												
012_02	Bear Canyon	1	710	EU# 1129	60%	2.38	1	700	2,000	90%	0.59	1	700	400	(2,000)	0%
012_02	Bear Canyon	2	500	EU# 1129	60%	2.38	1	500	1,000	70%	1.78	1	500	900	(100)	0%
012_02	Bear Canyon	3	1100	EU# 1303(1315)	78%	1.31	2	2,000	3,000	90%	0.59	2	2,000	1,000	(2,000)	0%
012_02	Bull Pen, The	1	660	grass	55%	2.67	1	700	2,000	60%	2.38	1	700	2,000	0	0%
012_02	Bull Pen, The	2	190	EU# 2606	88%	0.71	1	200	100	80%	1.19	1	200	200	100	-8%
012_02	Bull Pen, The	2	290	grass	55%	2.67	1	300	800	60%	2.38	1	300	700	(100)	0%
012_02	Bull Pen, The	2	1300	ephemeral												
012_02	Bull Pen, The	3	130	Geyer willow	82%	1.07	2	300	300	50%	2.97	2	300	900	600	-32%
012_02	Bull Pen, The	4	330	Geyer willow	82%	1.07	2	700	700	80%	1.19	2	700	800	100	-2%
012_02	Bull Pen, The	5	180	EU# 1303(1315)	78%	1.31	2	400	500	80%	1.19	2	400	500	0	0%
012_02	Bull Pen, The	6	320	Geyer willow	82%	1.07	2	600	600	70%	1.78	2	600	1,000	400	-12%
012_02	Bull Pen, The	7	190	Geyer willow	82%	1.07	2	400	400	50%	2.97	2	400	1,000	600	-32%
012_02	Bull Pen, The	8	120	Geyer willow	64%	2.14	3	400	900	10%	5.35	3	400	2,000	1,000	-54%
012_02	Bull Pen, The	9	990	Geyer willow	64%	2.14	3	3,000	6,000	40%	3.56	3	3,000	10,000	4,000	-24%
012_02	Bull Pen, The	10	630	Geyer willow	64%	2.14	3	2,000	4,000	50%	2.97	3	2,000	6,000	2,000	-14%
012_02	Bull Pen, The	11	1200	Geyer willow	53%	2.79	4	5,000	10,000	50%	2.97	4	5,000	10,000	0	-3%
012_02	Deer Canyon	1	3910	ephemeral												
							Totals		68,000					77,000	8,400	

Table E-14. Existing and target solar loads for Irving Creek (ID17040215SK012_03).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/ day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/ day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
012_03	Irving Creek	1	140	Geyer willow	45%	3.27	5	700	2,000	50%	2.97	5	700	2,000	0	0%
012_03	Irving Creek	2	1100	Geyer willow	45%	3.27	5	6,000	20,000	30%	4.16	5	6,000	20,000	0	-15%
012_03	Irving Creek	3	390	Geyer willow	45%	3.27	5	2,000	7,000	20%	4.75	5	2,000	10,000	3,000	-25%
012_03	Irving Creek	4	470	Geyer willow	45%	3.27	5	2,000	7,000	30%	4.16	5	2,000	8,000	1,000	-15%
012_03	Irving Creek	5	760	Geyer willow	40%	3.56	6	5,000	20,000	30%	4.16	6	5,000	20,000	0	-10%
012_03	Irving Creek	6	290	Geyer willow	40%	3.56	6	2,000	7,000	20%	4.75	6	2,000	10,000	3,000	-20%
012_03	Irving Creek	7	660	Geyer willow	40%	3.56	6	4,000	10,000	30%	4.16	6	4,000	20,000	10,000	-10%
012_03	Irving Creek	8	80	Geyer willow	40%	3.56	6	500	2,000	0%	5.94	6	500	3,000	1,000	-40%
012_03	Irving Creek	9	190	Geyer willow	40%	3.56	6	1,000	4,000	40%	3.56	6	1,000	4,000	0	0%
							Totals		79,000					97,000	18,000	

Table E-15. Existing and target solar loads for Medicine Lodge Creek tributaries (ID17040215SK011_02).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/ day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/ day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
011_02	trib 1	1	5200	ephemeral												
011_02	Cold Creek	1	1700	ephemeral												
011_02	Cold Creek	2	130	Geyer willow	53%	2.79	4	500	1,000	0%	5.94	4	500	3,000	2,000	-53%
011_02	Cold Creek	3	480	Geyer willow	53%	2.79	4	2,000	6,000	40%	3.56	4	2,000	7,000	1,000	-13%
011_02	Cold Creek	4	820	Geyer willow	53%	2.79	4	3,000	8,000	30%	4.16	4	3,000	10,000	2,000	-23%
011_02	Cold Creek	5	360	Geyer willow	53%	2.79	4	1,000	3,000	40%	3.56	4	1,000	4,000	1,000	-13%
011_02	Cole Canyon	1	290	EU# 1129	60%	2.38	1	300	700	90%	0.59	1	300	200	(500)	0%
011_02	Cole Canyon	2	540	EU# 1129	60%	2.38	1	500	1,000	70%	1.78	1	500	900	(100)	0%
011_02	Cole Canyon	3	550	EU# 1129	60%	2.38	1	600	1,000	90%	0.59	1	600	400	(600)	0%
011_02	Cole Canyon	4	460	sage/grass	39%	3.62	2	900	3,000	50%	2.97	2	900	3,000	0	0%
011_02	Cole Canyon	5	110	EU# 1129	59%	2.44	2	200	500	80%	1.19	2	200	200	(300)	0%
011_02	Cole Canyon	6	3120	ephemeral												
011_02	Cole Canyon	7	170	willow	64%	2.14	3	500	1,000	0%	5.94	3	500	3,000	2,000	-64%
011_02	Poison Gulch	1	3040	ephemeral												
011_02	trib 2	1	3600	ephemeral												
011_02	trib 3	1	3900	ephemeral												
011_02	trib 4	1	4100	ephemeral												
011_02	trib 4	2	90	willow	64%	2.14	3	300	600	0%	5.94	3	300	2,000	1,000	-64%
011_02	trib 4	3	300	willow	64%	2.14	3	900	2,000	60%	2.38	3	900	2,000	0	-4%
011_02	trib 4	4	740	willow	64%	2.14	3	2,000	4,000	50%	2.97	3	2,000	6,000	2,000	-14%
011_02	trib 4	5	320	willow	64%	2.14	3	1,000	2,000	40%	3.56	3	1,000	4,000	2,000	-24%
011_02	trib 4	6	490	willow	64%	2.14	3	1,000	2,000	30%	4.16	3	1,000	4,000	2,000	-34%
							Totals		36,000					50,000	14,000	

Table E-16. Existing and target solar loads for Medicine Lodge Creek (ID17040215SK011_03).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
011_03	Medicine Lodge Creek	1	1000	Geyer willow	29%	4.22	9	9,000	40,000	10%	5.35	9	9,000	50,000	10,000	-19%
011_03	Medicine Lodge Creek	2	220	Geyer willow	29%	4.22	9	2,000	8,000	0%	5.94	9	2,000	10,000	2,000	-29%
011_03	Medicine Lodge Creek	3	520	Geyer willow	29%	4.22	9	5,000	20,000	10%	5.35	9	5,000	30,000	10,000	-19%
011_03	Medicine Lodge Creek	4	270	Geyer willow	29%	4.22	9	2,000	8,000	20%	4.75	9	2,000	10,000	2,000	-9%
011_03	Medicine Lodge Creek	5	160	Geyer willow	26%	4.40	10	1,600	7,000	20%	4.75	10	1,600	7,600	600	-6%
011_03	Medicine Lodge Creek	6	310	Geyer willow	26%	4.40	10	3,100	14,000	0%	5.94	10	3,100	18,000	4,000	-26%
011_03	Medicine Lodge Creek	7	450	Geyer willow	26%	4.40	10	4,500	20,000	10%	5.35	10	4,500	24,000	4,000	-16%
							Totals		120,000					150,000	33,000	

Table E-17. Existing and target solar loads for Medicine Lodge Creek (ID17040215SK011_04).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
011_04	Medicine Lodge Creek	1	570	Geyer willow	24%	4.51	11	6,300	28,000	10%	5.35	11	6,300	34,000	6,000	-14%
011_04	Medicine Lodge Creek	2	420	Geyer willow	24%	4.51	11	4,600	21,000	20%	4.75	11	4,600	22,000	1,000	-4%
011_04	Medicine Lodge Creek	3	990	Geyer willow	24%	4.51	11	11,000	50,000	10%	5.35	11	11,000	59,000	9,000	-14%
011_04	Medicine Lodge Creek	4	140	Geyer willow	24%	4.51	11	1,500	6,800	0%	5.94	11	1,500	8,900	2,100	-24%
011_04	Medicine Lodge Creek	5	480	Geyer willow	24%	4.51	11	5,300	24,000	20%	4.75	11	5,300	25,000	1,000	-4%
011_04	Medicine Lodge Creek	6	720	Geyer willow	22%	4.63	12	8,600	40,000	10%	5.35	12	8,600	46,000	6,000	-12%
011_04	Medicine Lodge Creek	7	160	Geyer willow	22%	4.63	12	1,900	8,800	20%	4.75	12	1,900	9,000	200	-2%
011_04	Medicine Lodge Creek	8	160	Geyer willow	22%	4.63	12	1,900	8,800	0%	5.94	12	1,900	11,000	2,200	-22%
011_04	Medicine Lodge Creek	9	260	Geyer willow	22%	4.63	12	3,100	14,000	30%	4.16	12	3,100	13,000	(1,000)	0%
011_04	Medicine Lodge Creek	10	1500	Geyer willow	22%	4.63	12	18,000	83,000	20%	4.75	12	18,000	86,000	3,000	-2%
011_04	Medicine Lodge Creek	11	770	Geyer willow	22%	4.63	12	9,200	43,000	10%	5.35	12	9,200	49,000	6,000	-12%
011_04	Medicine Lodge Creek	12	340	Geyer willow	21%	4.69	13	4,400	21,000	10%	5.35	13	4,400	24,000	3,000	-11%
							Totals		350,000					390,000	39,000	

Table E-18. Existing and target solar loads for Medicine Lodge Creek (ID17040215SK006_04).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
006_04	Medicine Lodge Creek	1	350	Geyer willow	19%	4.81	14	4,900	24,000	0%	5.94	14	4,900	29,000	5,000	-19%
006_04	Medicine Lodge Creek	2	530	Geyer willow	19%	4.81	14	7,400	36,000	20%	4.75	14	7,400	35,000	(1,000)	0%
006_04	Medicine Lodge Creek	3	290	Geyer willow	19%	4.81	14	4,100	20,000	10%	5.35	14	4,100	22,000	2,000	-9%
006_04	Medicine Lodge Creek	4	180	Geyer willow	19%	4.81	14	2,500	12,000	0%	5.94	14	2,500	15,000	3,000	-19%
006_04	Medicine Lodge Creek	5	990	Geyer willow	19%	4.81	14	14,000	67,000	10%	5.35	14	14,000	75,000	8,000	0%
006_04	Medicine Lodge Creek	6	170	Geyer willow	19%	4.81	14	2,400	12,000	0%	5.94	14	2,400	14,000	2,000	-19%
006_04	Medicine Lodge Creek	7	450	Geyer willow	19%	4.81	14	6,300	30,000	20%	4.75	14	6,300	30,000	0	0%
006_04	Medicine Lodge Creek	8	1540	Geyer willow	19%	4.81	14	22,000	110,000	10%	5.35	14	22,000	120,000	10,000	-9%
006_04	Medicine Lodge Creek	10	450	Geyer willow	19%	4.81	14	6,300	30,000	0%	5.94	14	6,300	37,000	7,000	-19%
006_04	Medicine Lodge Creek	11	2480	Geyer willow	19%	4.81	14	35,000	170,000	10%	5.35	14	35,000	190,000	20,000	-9%
006_04	Medicine Lodge Creek	12	1010	water birch	23%	4.57	15	15,000	69,000	20%	4.75	15	15,000	71,000	2,000	-3%
006_04	Medicine Lodge Creek	14	340	water birch	23%	4.57	15	5,100	23,000	10%	5.35	15	5,100	27,000	4,000	-13%
006_04	Medicine Lodge Creek	15	480	water birch	23%	4.57	15	7,200	33,000	20%	4.75	15	7,200	34,000	1,000	0%
006_04	Medicine Lodge Creek	16	1200	water birch	23%	4.57	15	18,000	82,000	10%	5.35	15	18,000	96,000	14,000	-13%
006_04	Medicine Lodge Creek	17	820	water birch	23%	4.57	15	12,000	55,000	20%	4.75	15	12,000	57,000	2,000	-3%
006_04	Medicine Lodge Creek	18	1100	water birch	23%	4.57	15	17,000	78,000	0%	5.94	15	17,000	100,000	22,000	-23%
006_04	Medicine Lodge Creek	18	580	water birch	23%	4.57	15	8,700	40,000	10%	5.35	15	8,700	47,000	7,000	-13%
006_04	Medicine Lodge Creek	19	480	water birch	23%	4.57	15	7,200	33,000	20%	4.75	15	7,200	34,000	1,000	-3%
006_04	Medicine Lodge Creek	20	390	water birch	23%	4.57	15	5,900	27,000	10%	5.35	15	5,900	32,000	5,000	-13%
006_04	Medicine Lodge Creek	21	1200	water birch	22%	4.63	16	19,000	88,000	10%	5.35	16	19,000	100,000	12,000	-12%
006_04	Medicine Lodge Creek	22	1100	water birch	22%	4.63	16	18,000	83,000	0%	5.94	16	18,000	110,000	27,000	-22%
006_04	Medicine Lodge Creek	22	1020	water birch	22%	4.63	16	16,000	74,000	10%	5.35	16	16,000	86,000	12,000	-12%
006_04	Medicine Lodge Creek	24	580	water birch	22%	4.63	16	9,300	43,000	0%	5.94	16	9,300	55,000	12,000	-22%
006_04	Medicine Lodge Creek	25	310	water birch	22%	4.63	16	5,000	23,000	10%	5.35	16	5,000	27,000	4,000	-12%
006_04	Medicine Lodge Creek	26	1500	water birch	22%	4.63	16	24,000	110,000	0%	5.94	16	24,000	140,000	30,000	-22%
006_04	Medicine Lodge Creek	27	240	water birch	22%	4.63	16	3,800	18,000	10%	5.35	16	3,800	20,000	2,000	-12%
006_04	Medicine Lodge Creek	28	940	water birch	22%	4.63	16	15,000	69,000	0%	5.94	16	15,000	89,000	20,000	-22%
006_04	Medicine Lodge Creek	29	240	water birch	20%	4.75	17	4,100	19,000	0%	5.94	17	4,100	24,000	5,000	-20%
006_04	Medicine Lodge Creek	30	920	water birch	20%	4.75	17	16,000	76,000	30%	4.16	17	16,000	67,000	(9,000)	0%
006_04	Medicine Lodge Creek	31	260	water birch	20%	4.75	17	4,400	21,000	20%	4.75	17	4,400	21,000	0	0%
006_04	Medicine Lodge Creek	32	1600	water birch	19%	4.81	18	29,000	140,000	20%	4.75	18	29,000	140,000	0	0%
							Totals		1,700,000					1,900,000	230,000	

Table E-19. Existing and target solar loads for Medicine Lodge Creek (ID17040215SK002_04).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
002_04	Medicine Lodge Creek	1	150	water birch	19%	4.81	18	2,700	13,000	20%	4.75	18	2,700	13,000	0	0%
002_04	Medicine Lodge Creek	2	1200	sandbar willow	17%	4.93	18	22,000	110,000	0%	5.94	18	22,000	130,000	20,000	-17%
002_04	Medicine Lodge Creek	2	1100	sandbar willow	17%	4.93	18	20,000	99,000	10%	5.35	18	20,000	110,000	11,000	-7%
002_04	Medicine Lodge Creek	3	320	sandbar willow	17%	4.93	18	5,800	29,000	20%	4.75	18	5,800	28,000	(1,000)	0%
002_04	Medicine Lodge Creek	4	620	sandbar willow	17%	4.93	18	11,000	54,000	20%	4.75	18	11,000	52,000	(2,000)	0%
002_04	Medicine Lodge Creek	5	650	sandbar willow	17%	4.93	18	12,000	59,000	20%	4.75	18	12,000	57,000	(2,000)	0%
002_04	Medicine Lodge Creek	6	170	sandbar willow	17%	4.93	18	3,100	15,000	10%	5.35	18	3,100	17,000	2,000	-7%
002_04	Medicine Lodge Creek	7	430	sandbar willow	17%	4.93	18	7,700	38,000	10%	5.35	18	7,700	41,000	3,000	-7%
002_04	Medicine Lodge Creek	8	510	sandbar willow	17%	4.93	18	9,200	45,000	20%	4.75	18	9,200	44,000	(1,000)	0%
002_04	Medicine Lodge Creek	9	1130	sandbar willow	17%	4.93	18	20,000	99,000	20%	4.75	18	20,000	95,000	(4,000)	0%
002_04	Medicine Lodge Creek	10	440	sandbar willow	17%	4.93	18	7,900	39,000	10%	5.35	18	7,900	42,000	3,000	-7%
002_04	Medicine Lodge Creek	11	720	sandbar willow	17%	4.93	18	13,000	64,000	20%	4.75	18	13,000	62,000	(2,000)	0%
002_04	Medicine Lodge Creek	12	210	sandbar willow	17%	4.93	18	3,800	19,000	10%	5.35	18	3,800	20,000	1,000	-7%
002_04	Medicine Lodge Creek	13	190	sandbar willow	17%	4.93	18	3,400	17,000	10%	5.35	18	3,400	18,000	1,000	-7%
002_04	Medicine Lodge Creek	14	240	sandbar willow	17%	4.93	18	4,300	21,000	20%	4.75	18	4,300	20,000	(1,000)	0%
002_04	Medicine Lodge Creek	15	280	sandbar willow	17%	4.93	18	5,000	25,000	20%	4.75	18	5,000	24,000	(1,000)	0%
002_04	Medicine Lodge Creek	16	260	sandbar willow	17%	4.93	18	4,700	23,000	20%	4.75	18	4,700	22,000	(1,000)	0%
002_04	Medicine Lodge Creek	17	1100	sandbar willow	17%	4.93	18	20,000	99,000	0%	5.94	18	20,000	120,000	21,000	-17%
							Totals		870,000					920,000	47,000	

Table E-20. Existing and target solar loads for Middle Creek (ID17040215SK008_02).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
008_02	Middle Creek	1	890	ephemeral												
008_02	Middle Creek	2	440	EU# 2606	88%	0.71	1	400	300	80%	1.19	1	400	500	200	-8%
008_02	Middle Creek	3	110	EU# 2606	58%	2.49	2	200	500	50%	2.97	2	200	600	100	-8%
008_02	Middle Creek	4	210	EU# 2606	58%	2.49	2	400	1,000	60%	2.38	2	400	1,000	0	0%
008_02	Middle Creek	5	140	EU# 2606	58%	2.49	2	300	700	40%	3.56	2	300	1,000	300	-18%
008_02	Middle Creek	6	280	EU# 2606	58%	2.49	2	600	1,000	50%	2.97	2	600	2,000	1,000	-8%
008_02	Middle Creek	7	96	EU# 2606	58%	2.49	2	200	500	40%	3.56	2	200	700	200	-18%
008_02	Middle Creek	8	380	EU# 2606	58%	2.49	2	800	2,000	10%	5.35	2	800	4,000	2,000	-48%
008_02	Middle Creek	9	460	EU# 2606	43%	3.39	3	1,000	3,000	50%	2.97	3	1,000	3,000	0	0%
008_02	Middle Creek	10	380	EU# 2606	43%	3.39	3	1,000	3,000	30%	4.16	3	1,000	4,000	1,000	-13%
008_02	Middle Creek	11	180	EU# 2606	43%	3.39	3	500	2,000	50%	2.97	3	500	1,000	(1,000)	0%
008_02	Middle Creek	12	980	EU# 2606	35%	3.86	4	4,000	20,000	40%	3.56	4	4,000	10,000	(10,000)	0%
008_02	Middle Creek	13	280	EU# 2606	35%	3.86	4	1,000	4,000	30%	4.16	4	1,000	4,000	0	-5%
008_02	Middle Creek	14	340	Geyer willow	45%	3.27	5	2,000	7,000	40%	3.56	5	2,000	7,000	0	-5%
008_02	Middle Creek	15	430	Geyer willow	45%	3.27	5	2,000	7,000	30%	4.16	5	2,000	8,000	1,000	-15%
008_02	Middle Creek	16	250	Geyer willow	45%	3.27	5	1,000	3,000	40%	3.56	5	1,000	4,000	1,000	-5%
008_02	Middle Creek	17	420	Geyer willow	45%	3.27	5	2,000	7,000	30%	4.16	5	2,000	8,000	1,000	-15%
008_02	Middle Creek	18	63	Geyer willow	45%	3.27	5	300	1,000	40%	3.56	5	300	1,000	0	-5%
008_02	Middle Creek	19	1290	Geyer willow	45%	3.27	5	6,000	20,000	30%	4.16	5	6,000	20,000	0	-15%
008_02	Middle Creek	20	590	Geyer willow	45%	3.27	5	3,000	10,000	50%	2.97	5	3,000	9,000	(1,000)	0%
008_02	Middle Creek	21	190	Geyer willow	45%	3.27	5	1,000	3,000	40%	3.56	5	1,000	4,000	1,000	-5%
008_02	Middle Creek	22	340	Geyer willow	45%	3.27	5	2,000	7,000	10%	5.35	5	2,000	10,000	3,000	-35%
008_02	Middle Creek	23	310	Geyer willow	45%	3.27	5	2,000	7,000	40%	3.56	5	2,000	7,000	0	-5%
008_02	Middle Creek	24	270	Geyer willow	45%	3.27	5	1,000	3,000	50%	2.97	5	1,000	3,000	0	0%
008_02	Broad Hollow	1	830	grass	55%	2.67	1	800	2,000	60%	2.38	1	800	2,000	0	0%
008_02	Broad Hollow	2	930	EU# 1149	88%	0.71	1	900	600	80%	1.19	1	900	1,000	400	-8%
008_02	Broad Hollow	3	210	EU# 1149	87%	0.77	2	400	300	60%	2.38	2	400	1,000	700	-27%
008_02	Broad Hollow	4	140	EU# 1149	87%	0.77	2	300	200	80%	1.19	2	300	400	200	-7%
008_02	Broad Hollow	5	50	Geyer willow	82%	1.07	2	100	100	40%	3.56	2	100	400	300	-42%
008_02	Broad Hollow	6	580	Geyer willow	82%	1.07	2	1,000	1,000	70%	1.78	2	1,000	2,000	1,000	-12%
008_02	Broad Hollow	7	130	Geyer willow	82%	1.07	2	300	300	40%	3.56	2	300	1,000	700	-42%
008_02	Poison Creek	1	1000	grass	55%	2.67	1	1,000	3,000	40%	3.56	1	1,000	4,000	1,000	-15%
008_02	Poison Creek	2	65	EU# 2606	88%	0.71	1	70	50	60%	2.38	1	70	200	200	-28%
008_02	Poison Creek	3	590	grass	55%	2.67	1	600	2,000	40%	3.56	1	600	2,000	0	-15%
008_02	Poison Creek	4	400	EU# 2606	88%	0.71	1	400	300	60%	2.38	1	400	1,000	700	-28%
008_02	Poison Creek	5	1500	grass	31%	4.10	2	3,000	10,000	30%	4.16	2	3,000	10,000	0	-1%
008_02	Poison Creek	6	440	Geyer willow	82%	1.07	2	900	1,000	70%	1.78	2	900	2,000	1,000	-12%
008_02	Poison Creek	7	210	Geyer willow	82%	1.07	2	400	400	80%	1.19	2	400	500	100	-2%
008_02	Poison Creek	8	430	Geyer willow	82%	1.07	2	900	1,000	40%	3.56	2	900	3,000	2,000	-42%
008_02	Wood Canyon	1	650	grass	55%	2.67	1	700	2,000	60%	2.38	1	700	2,000	0	0%
008_02	Wood Canyon	2	700	grass	55%	2.67	1	700	2,000	50%	2.97	1	700	2,000	0	-5%
008_02	Wood Canyon	3	310	Geyer willow	82%	1.07	2	600	600	50%	2.97	2	600	2,000	1,000	-32%
008_02	Wood Canyon	4	110	Geyer willow	82%	1.07	2	200	200	80%	1.19	2	200	200	0	-2%
008_02	Wood Canyon	5	690	ephemeral												
008_02	Wood Canyon	6	230	Geyer willow	82%	1.07	2	500	500	80%	1.19	2	500	600	100	-2%
							Totals		140,000					150,000	9,200	

Table E-21. Existing and target solar loads for Middle Creek (ID17040215SK007_02).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
007_02	Middle Creek	1	840	Geyer willow	40%	3.56	6	5,000	20,000	40%	3.56	6	5,000	20,000	0	0%
007_02	Middle Creek	2	230	Geyer willow	40%	3.56	6	1,000	4,000	30%	4.16	6	1,000	4,000	0	-10%
007_02	Middle Creek	3	180	Geyer willow	40%	3.56	6	1,000	4,000	10%	5.35	6	1,000	5,000	1,000	-30%
007_02	Middle Creek	4	320	Geyer willow	40%	3.56	6	2,000	7,000	50%	2.97	6	2,000	6,000	(1,000)	10%
007_02	Middle Creek	5	720	Geyer willow	40%	3.56	6	4,000	10,000	30%	4.16	6	4,000	20,000	10,000	-10%
007_02	Middle Creek	6	210	Geyer willow	40%	3.56	6	1,000	4,000	10%	5.35	6	1,000	5,000	1,000	-30%
007_02	Middle Creek	7	180	Geyer willow	40%	3.56	6	1,000	4,000	0%	5.94	6	1,000	6,000	2,000	-40%
007_02	Middle Creek	8	470	Geyer willow	40%	3.56	6	3,000	10,000	40%	3.56	6	3,000	10,000	0	0%
007_02	Middle Creek	9	330	Geyer willow	40%	3.56	6	2,000	7,000	30%	4.16	6	2,000	8,000	1,000	-10%
007_02	Middle Creek	10	140	Geyer willow	40%	3.56	6	800	3,000	20%	4.75	6	800	4,000	1,000	-20%
007_02	Middle Creek	11	190	Geyer willow	40%	3.56	6	1,000	4,000	30%	4.16	6	1,000	4,000	0	-10%
007_02	Middle Creek	12	920	Geyer willow	40%	3.56	6	6,000	20,000	20%	4.75	6	6,000	30,000	10,000	-20%
007_02	Middle Creek	13	790	Geyer willow	40%	3.56	6	5,000	20,000	40%	3.56	6	5,000	20,000	0	0%
007_02	Middle Creek	14	180	Geyer willow	40%	3.56	6	1,000	4,000	30%	4.16	6	1,000	4,000	0	-10%
007_02	Middle Creek	15	140	Geyer willow	40%	3.56	6	800	3,000	0%	5.94	6	800	5,000	2,000	-40%
007_02	Dead Horse Creek	1	990	grass	55%	2.67	1	1,000	3,000	50%	2.97	1	1,000	3,000	0	-5%
007_02	Dead Horse Creek	2	1600	ephemeral												
007_02	Dead Horse Creek	3	170	Geyer willow	82%	1.07	2	300	300	60%	2.38	2	300	700	400	-22%
007_02	Dead Horse Creek	4	190	grass	31%	4.10	2	400	2,000	40%	3.56	2	400	1,000	(1,000)	0%
007_02	Dead Horse Creek	5	1700	ephemeral												
007_02	Dead Horse Creek	6	230	grass	21%	4.69	3	700	3,000	20%	4.75	3	700	3,000	0	0%
007_02	Dead Horse Creek	7	1200	ephemeral												
007_02	Dead Horse trib	1	670	grass	55%	2.67	1	700	2,000	50%	2.97	1	700	2,000	0	-5%
007_02	Dead Horse trib	2	1500	ephemeral												
007_02	Rocky Creek	1	16200	ephemeral												
007_02	Rocky trib	1	12890	ephemeral												
							Totals		130,000					160,000	26,000	

Table E-22. Existing and target solar loads for Middle Creek (ID17040215SK007_03).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
007_03	Middle Creek	1	300	water birch	58%	2.49	7	2,000	5,000	60%	2.38	7	2,000	5,000	0	0%
007_03	Middle Creek	2	530	water birch	58%	2.49	7	4,000	10,000	40%	3.56	7	4,000	10,000	0	-18%
007_03	Middle Creek	3	300	Geyer willow	35%	3.86	7	2,000	8,000	30%	4.16	7	2,000	8,000	0	-5%
007_03	Middle Creek	4	260	Geyer willow	35%	3.86	7	2,000	8,000	10%	5.35	7	2,000	10,000	2,000	-25%
007_03	Middle Creek	5	1500	Geyer willow	35%	3.86	7	10,000	40,000	20%	4.75	7	10,000	50,000	10,000	-15%
007_03	Middle Creek	6	300	Geyer willow	35%	3.86	7	2,000	8,000	10%	5.35	7	2,000	10,000	2,000	-25%
007_03	Middle Creek	7	500	Geyer willow	35%	3.86	7	4,000	20,000	30%	4.16	7	4,000	20,000	0	-5%
007_03	Middle Creek	8	670	Geyer willow	35%	3.86	7	5,000	20,000	20%	4.75	7	5,000	20,000	0	-15%
007_03	Middle Creek	9	530	Geyer willow	35%	3.86	7	4,000	20,000	10%	5.35	7	4,000	20,000	0	-25%
007_03	Middle Creek	10	270	Geyer willow	35%	3.86	7	2,000	8,000	30%	4.16	7	2,000	8,000	0	-5%
007_03	Middle Creek	11	170	Geyer willow	35%	3.86	7	1,000	4,000	10%	5.35	7	1,000	5,000	1,000	-25%
007_03	Middle Creek	12	350	Geyer willow	31%	4.10	8	3,000	10,000	30%	4.16	8	3,000	10,000	0	-1%
007_03	Middle Creek	13	680	Geyer willow	29%	4.22	9	6,000	30,000	40%	3.56	9	6,000	20,000	(10,000)	0%
007_03	Middle Creek	14	320	Geyer willow	29%	4.22	9	3,000	10,000	30%	4.16	9	3,000	10,000	0	0%
007_03	Middle Creek	15	85	beaver pond	29%	4.22	9	800	3,000	20%	4.75	9	800	4,000	1,000	-9%
007_03	Middle Creek	16	320	Geyer willow	29%	4.22	9	3,000	10,000	30%	4.16	9	3,000	10,000	0	0%
007_03	Middle Creek	17	250	Geyer willow	29%	4.22	9	2,000	8,000	10%	5.35	9	2,000	10,000	2,000	-19%
007_03	Middle Creek	18	87	Geyer willow	29%	4.22	9	800	3,000	30%	4.16	9	800	3,000	0	0%
007_03	Middle Creek	19	310	Geyer willow	29%	4.22	9	3,000	10,000	20%	4.75	9	3,000	10,000	0	-9%
007_03	Middle Creek	20	170	Geyer willow	29%	4.22	9	2,000	8,000	30%	4.16	9	2,000	8,000	0	0%
007_03	Middle Creek	21	1050	Geyer willow	29%	4.22	9	9,000	40,000	20%	4.75	9	9,000	40,000	0	-9%
007_03	Middle Creek	22	50	Geyer willow	29%	4.22	9	500	2,000	0%	5.94	9	500	3,000	1,000	-29%
							Totals		290,000					290,000	9,000	

Table E-23. Existing and target solar loads for Warm Creek (ID17040215SK013_02).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
013_02	Warm Creek	1	2320	ephemeral												
013_02	Warm Creek	3	780	EU# 1133(1760)	48%	3.09	2	2,000	6,000	40%	3.56	2	2,000	7,000	1,000	-8%
013_02	Warm Creek	4	570	grass	31%	4.10	2	1,000	4,000	40%	3.56	2	1,000	4,000	0	0%
013_02	Warm Creek	5	670	EU# 1129	56%	2.61	3	2,000	5,000	70%	1.78	3	2,000	4,000	(1,000)	0%
013_02	Warm Creek	6	1180	grass	27%	4.34	3	4,000	20,000	30%	4.16	3	4,000	20,000	0	0%
013_02	Warm Creek	8	340	EU# 1133(1760)	31%	4.10	4	1,000	4,000	60%	2.38	4	1,000	2,000	(2,000)	0%
013_02	Warm Creek	9	1310	EU# 1133(1760)	31%	4.10	4	5,000	20,000	40%	3.56	4	5,000	20,000	0	0%
013_02	Warm Creek	11	240	Geyer willow	53%	2.79	4	1,000	3,000	60%	2.38	4	1,000	2,000	(1,000)	0%
013_02	Warm Creek	12	110	EU# 1133(1760)	31%	4.10	4	400	2,000	40%	3.56	4	400	1,000	(1,000)	0%
013_02	Warm Creek	13	210	grass	16%	4.99	4	800	4,000	20%	4.75	4	800	4,000	0	0%
013_02	Limestone Gulch	1	1300	sage/grass	65%	2.08	1	1,000	2,000	50%	2.97	1	1,000	3,000	1,000	-15%
013_02	Limestone Gulch	2	1300	sage/grass	39%	3.62	2	3,000	10,000	30%	4.16	2	3,000	10,000	0	-9%
013_02	2nd tributary	1	1100	ephemeral	0%	5.94	1	1,000	6,000	0%	5.94	1	1,000	6,000	0	0%
013_02	2nd tributary	2	1300	EU# 1129	59%	2.44	2	3,000	7,000	70%	1.78	2	3,000	5,000	(2,000)	0%
013_02	2nd tributary	3	1400	ephemeral												
013_02	Black Canyon	1	1500	EU# 1129	60%	2.38	1	2,000	5,000	90%	0.59	1	2,000	1,000	(4,000)	0%
013_02	Black Canyon	2	960	sage/grass	39%	3.62	2	2,000	7,000	40%	3.56	2	2,000	7,000	0	
013_02	Black Canyon	3	300	EU# 1133(1760)	48%	3.09	2	600	2,000	90%	0.59	2	600	400	(2,000)	0%
013_02	Black Canyon	4	630	ephemeral												
013_02	4th tributary	1	480	EU# 1129	60%	2.38	1	500	1,000	80%	1.19	1	500	600	(400)	0%
013_02	4th tributary	2	2600	ephemeral												
013_02	5th tributary	1	3000	ephemeral												
							Totals		110,000					97,000	-11,000	

Table E-24. Existing and target solar loads for Warm Creek (ID17040215SK013_03).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
013_03	Warm Creek	1	90	Geyer willow	40%	3.56	6	500	2,000	30%	4.16	6	500	2,000	0	-10%
013_03	Warm Creek	2	1570	Geyer willow	40%	3.56	6	9,000	30,000	20%	4.75	6	9,000	40,000	10,000	-20%
013_03	Warm Creek	3	220	Geyer willow	40%	3.56	6	1,000	4,000	40%	3.56	6	1,000	4,000	0	0%
013_03	Warm Creek	4	1730	Geyer willow	35%	3.86	7	10,000	40,000	10%	5.35	7	10,000	50,000	10,000	-25%
013_03	Warm Creek	5	260	Geyer willow	31%	4.10	8	2,000	8,000	30%	4.16	8	2,000	8,000	0	-1%
							Totals		84,000					100,000	20,000	

Table E-25. Existing and target solar loads for Webber Creek (ID17040215SK017_02).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
017_02	Webber Creek	1	2100	EU# 1154	65%	2.08	1	2,000	4,000	80%	1.19	1	2,000	2,000	(2,000)	0%
017_02	Webber Creek	2	460	EU# 1154	63%	2.20	3	1,000	2,000	90%	0.59	3	1,000	600	(1,000)	0%
017_02	Webber Creek	3	230	alder	72%	1.66	3	700	1,000	40%	3.56	3	700	2,000	1,000	-32%
017_02	Webber Creek	4	560	EU# 1154	63%	2.20	3	2,000	4,000	80%	1.19	3	2,000	2,000	(2,000)	0%
017_02	Webber Creek	5	400	Geyer willow	53%	2.79	4	2,000	6,000	50%	2.97	4	2,000	6,000	0	-3%
017_02	Webber Creek	6	300	Geyer willow	53%	2.79	4	1,000	3,000	40%	3.56	4	1,000	4,000	1,000	-13%
017_02	Webber Creek	7	84	Geyer willow	53%	2.79	4	300	800	30%	4.16	4	300	1,000	200	-23%
017_02	Webber Creek	8	260	Geyer willow	53%	2.79	4	1,000	3,000	40%	3.56	4	1,000	4,000	1,000	-13%
017_02	Webber Creek	9	330	Geyer willow	53%	2.79	4	1,000	3,000	60%	2.38	4	1,000	2,000	(1,000)	0%
017_02	Webber Creek	10	310	EU# 2606	35%	3.86	4	1,000	4,000	80%	1.19	4	1,000	1,000	(3,000)	0%
017_02	Webber Creek	11	180	Geyer willow	53%	2.79	4	700	2,000	60%	2.38	4	700	2,000	0	0%
017_02	Webber Creek	12	150	Geyer willow	53%	2.79	4	600	2,000	50%	2.97	4	600	2,000	0	-3%
017_02	Webber Creek	13	310	Geyer willow	53%	2.79	4	1,000	3,000	40%	3.56	4	1,000	4,000	1,000	-13%
017_02	Webber Creek	14	190	EU# 2606	35%	3.86	4	800	3,000	50%	2.97	4	800	2,000	(1,000)	0%
017_02	Webber Creek	15	300	Geyer willow	53%	2.79	4	1,000	3,000	40%	3.56	4	1,000	4,000	1,000	-13%
017_02	Webber Creek	16	320	EU# 2606	29%	4.22	5	2,000	8,000	70%	1.78	5	2,000	4,000	(4,000)	0%
017_02	Webber Creek	17	560	Geyer willow	45%	3.27	5	3,000	10,000	50%	2.97	5	3,000	9,000	(1,000)	0%
017_02	Webber Creek	18	70	Geyer willow	45%	3.27	5	400	1,000	30%	4.16	5	400	2,000	1,000	-15%
017_02	Webber Creek	19	260	EU# 2606	29%	4.22	5	1,000	4,000	60%	2.38	5	1,000	2,000	(2,000)	0%
017_02	Webber Creek	20	580	EU# 2606	29%	4.22	5	3,000	10,000	70%	1.78	5	3,000	5,000	(5,000)	0%
017_02	Webber Creek	21	210	EU# 2606	29%	4.22	5	1,000	4,000	60%	2.38	5	1,000	2,000	(2,000)	0%
017_02	Webber Creek	22	120	Geyer willow	45%	3.27	5	600	2,000	40%	3.56	5	600	2,000	0	-5%
017_02	Webber Creek	23	220	EU# 2606	29%	4.22	5	1,000	4,000	50%	2.97	5	1,000	3,000	(1,000)	0%
017_02	Webber Creek	24	230	Geyer willow	45%	3.27	5	1,000	3,000	40%	3.56	5	1,000	4,000	1,000	-5%
017_02	Webber Creek	25	580	Geyer willow	45%	3.27	5	3,000	10,000	50%	2.97	5	3,000	9,000	(1,000)	0%
017_02	Webber Creek	26	200	EU# 2606	26%	4.40	6	1,000	4,000	60%	2.38	6	1,000	2,000	(2,000)	0%
017_02	Webber Creek	27	250	Geyer willow	40%	3.56	6	2,000	7,000	50%	2.97	6	2,000	6,000	(1,000)	0%
017_02	Webber Creek	28	220	EU# 2606	26%	4.40	6	1,000	4,000	80%	1.19	6	1,000	1,000	(3,000)	0%
017_02	Webber Creek	29	650	Geyer willow	40%	3.56	6	4,000	10,000	70%	1.78	6	4,000	7,000	(3,000)	0%
017_02	Webber Creek	30	1720	Geyer willow	40%	3.56	6	10,000	40,000	50%	2.97	6	10,000	30,000	(10,000)	0%
017_02	Webber Creek	31	220	Geyer willow	35%	3.86	7	2,000	8,000	40%	3.56	7	2,000	7,000	(1,000)	0%
017_02	Webber Creek	32	110	Geyer willow	35%	3.86	7	800	3,000	30%	4.16	7	800	3,000	0	-5%
017_02	Webber Creek	33	160	Geyer willow	35%	3.86	7	1,000	4,000	10%	5.35	7	1,000	5,000	1,000	-25%
017_02	Webber Creek	34	1420	Geyer willow	35%	3.86	7	10,000	40,000	40%	3.56	7	10,000	40,000	0	5%
017_02	Webber Creek	35	900	Geyer willow	35%	3.86	7	6,000	20,000	30%	4.16	7	6,000	20,000	0	-5%
017_02	Webber Creek	36	210	Geyer willow	35%	3.86	7	1,000	4,000	10%	5.35	7	1,000	5,000	1,000	-25%
017_02	Webber Creek	37	560	Geyer willow	35%	3.86	7	4,000	20,000	30%	4.16	7	4,000	20,000	0	-5%
017_02	Webber Creek	38	170	Geyer willow	35%	3.86	7	1,000	4,000	40%	3.56	7	1,000	4,000	0	0%
017_02	Webber Creek	39	130	Geyer willow	35%	3.86	7	900	3,000	10%	5.35	7	900	5,000	2,000	-25%
017_02	Webber Creek	40	590	Geyer willow	35%	3.86	7	4,000	20,000	30%	4.16	7	4,000	20,000	0	-5%
017_02	Webber Creek	41	280	Geyer willow	35%	3.86	7	2,000	8,000	20%	4.75	7	2,000	10,000	2,000	-15%
017_02	Webber Creek	42	190	Geyer willow	35%	3.86	7	1,000	4,000	10%	5.35	7	1,000	5,000	1,000	-25%
017_02	Webber Creek	43	310	Geyer willow	35%	3.86	7	2,000	8,000	30%	4.16	7	2,000	8,000	0	-5%

Table E-25 continued.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
017_02	1st tributary	1	900	EU# 1154	65%	2.08	1	900	2,000	80%	1.19	1	900	1,000	(1,000)	0%
017_02	1st tributary	2	160	EU# 1154	64%	2.14	2	300	600	60%	2.38	2	300	700	100	-4%
017_02	1st tributary	3	150	EU# 1154	64%	2.14	2	300	600	80%	1.19	2	300	400	(200)	0%
017_02	1st tributary	4	73	EU# 1154	64%	2.14	2	100	200	60%	2.38	2	100	200	0	-4%
017_02	1st tributary	5	850	EU# 1154	63%	2.20	3	3,000	7,000	80%	1.19	3	3,000	4,000	(3,000)	0%
017_02	North Fork Webber Creek	1	1100	EU# 1280(alpine)	55%	2.67	1	1,000	3,000	60%	2.38	1	1,000	2,000	(1,000)	0%
017_02	North Fork Webber Creek	2	160	water	0%	5.94	1	200	1,000	0%	5.94	1	200	1,000	0	0%
017_02	North Fork Webber Creek	3	120	EU# 1280(alpine)	55%	2.67	1	100	300	60%	2.38	1	100	200	(100)	0%
017_02	North Fork Webber Creek	4	240	EU# 1154	65%	2.08	1	200	400	70%	1.78	1	200	400	0	0%
017_02	North Fork Webber Creek	5	130	water	0%	5.94	1	100	600	0%	5.94	1	100	600	0	0%
017_02	North Fork Webber Creek	6	210	EU# 1154	64%	2.14	2	400	900	50%	2.97	2	400	1,000	100	-14%
017_02	North Fork Webber Creek	7	1200	EU# 1154	64%	2.14	2	2,000	4,000	70%	1.78	2	2,000	4,000	0	0%
017_02	North Fork Webber Creek	8	1100	EU# 2606	43%	3.39	3	3,000	10,000	40%	3.56	3	3,000	10,000	0	-3%
017_02	North Fork Webber Creek	9	640	EU# 2606	43%	3.39	3	2,000	7,000	50%	2.97	3	2,000	6,000	(1,000)	0%
017_02	North Fork Webber Creek	10	600	EU# 2606	43%	3.39	3	2,000	7,000	70%	1.78	3	2,000	4,000	(3,000)	0%
017_02	South Fork Webber Creek	1	590	EU# 1154	65%	2.08	1	600	1,000	60%	2.38	1	600	1,000	0	-5%
017_02	South Fork Webber Creek	2	510	EU# 1154	65%	2.08	1	500	1,000	80%	1.19	1	500	600	(400)	0%
017_02	South Fork Webber Creek	3	250	EU# 1154	65%	2.08	1	300	600	60%	2.38	1	300	700	100	-5%
017_02	South Fork Webber Creek	4	220	EU# 1154	65%	2.08	1	200	400	80%	1.19	1	200	200	(200)	0%
017_02	South Fork Webber Creek	5	260	EU# 1154	64%	2.14	2	500	1,000	60%	2.38	2	500	1,000	0	-4%
017_02	South Fork Webber Creek	6	610	EU# 1154	64%	2.14	2	1,000	2,000	90%	0.59	2	1,000	600	(1,000)	0%
017_02	South Fork Webber Creek	7	460	grass	31%	4.10	2	900	4,000	40%	3.56	2	900	3,000	(1,000)	0%
017_02	South Fork Webber Creek	8	180	Geyer willow	82%	1.07	2	400	400	70%	1.78	2	400	700	300	-12%
017_02	4th tributary	1	1200	EU# 1154	65%	2.08	1	1,000	2,000	80%	1.19	1	1,000	1,000	(1,000)	0%
017_02	4th tributary	2	1100	EU# 1154	65%	2.08	1	1,000	2,000	60%	2.38	1	1,000	2,000	0	-5%
017_02	4th tributary	3	390	EU# 1129	60%	2.38	1	400	1,000	80%	1.19	1	400	500	(500)	0%
017_02	McNeary Creek	1	1600	EU# 1154	65%	2.08	1	2,000	4,000	90%	0.59	1	2,000	1,000	(3,000)	0%
017_02	McNeary Creek	2	220	EU# 1154	65%	2.08	1	200	400	60%	2.38	1	200	500	100	-5%
017_02	McNeary Creek	3	1700	EU# 1154	64%	2.14	2	3,000	6,000	80%	1.19	2	3,000	4,000	(2,000)	0%
017_02	McNeary Creek	4	110	EU# 1154	64%	2.14	2	200	400	60%	2.38	2	200	500	100	-4%
017_02	McNeary Creek	5	130	EU# 1129	59%	2.44	2	300	700	80%	1.19	2	300	400	(300)	0%
017_02	McNeary Creek	6	380	EU# 1129	59%	2.44	2	800	2,000	60%	2.38	2	800	2,000	0	0%
017_02	McNeary Creek	7	1700	EU# 1129	56%	2.61	3	5,000	10,000	70%	1.78	3	5,000	9,000	(1,000)	0%
017_02	McNeary Creek	8	290	EU# 1133(1760)	37%	3.74	3	900	3,000	30%	4.16	3	900	4,000	1,000	-7%
017_02	Robertson Gulch	1	1300	EU# 1129	60%	2.38	1	1,000	2,000	90%	0.59	1	1,000	600	(1,000)	0%
017_02	Robertson Gulch	2	330	EU# 1129	60%	2.38	1	300	700	60%	2.38	1	300	700	0	0%
017_02	Robertson Gulch	3	620	EU# 1133(1760)	48%	3.09	2	1,000	3,000	50%	2.97	2	1,000	3,000	0	0%
017_02	Robertson Gulch	4	790	EU# 1129	59%	2.44	2	2,000	5,000	60%	2.38	2	2,000	5,000	0	0%
017_02	Robertson Gulch	5	850	grass	21%	4.69	3	3,000	10,000	30%	4.16	3	3,000	10,000	0	0%
017_02	Robertson Gulch	6	490	EU# 1129	56%	2.61	3	1,000	3,000	60%	2.38	3	1,000	2,000	(1,000)	0%
017_02	Robertson Gulch	7	1100	ephemeral												
017_02	tributary to Robertson	1	1300	EU# 1129	60%	2.38	1	1,000	2,000	80%	1.19	1	1,000	1,000	(1,000)	0%
017_02	tributary to Robertson	2	650	EU# 1133(1760)	48%	3.09	2	1,000	3,000	50%	2.97	2	1,000	3,000	0	0%
017_02	tributary to Robertson	3	1100	ephemeral												
							Totals		430,000					370,000	-53,000	

Appendix F. Public Participation and Public Comments

Development of this Medicine Lodge Creek subbasin TMDL addendum and 5-year review will include a public comment period on the draft document. The Clark Soil Conservation District (SCD) agreed to act as a Watershed Advisory Group for the Medicine Lodge Creek subbasin. In accordance with Idaho Code §39-3601 et. seq., Clark SCD, representing the agricultural interests, invited other interested sectors (e.g., environmental or timber) to vote on TMDL development in the subbasin Clark SCD reviewed the public comment draft TMDL addendum, and upon approval, the TMDL addendum will be advertised for public comment.

After all interested parties have an opportunity to review and comment on the water quality issues impacting this subbasin, DEQ will respond to the comments by amending the document or clarifying issues as necessary. Comments received from the public and DEQ's response to those comments, as well as a distribution list, will be published in the final TMDL addendum.

[Public comments and DEQ responses to be inserted following public comment period.]

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Appendix G. Distribution List

[To be inserted following public comment period.]